ENVIRONMENTAL SUSTAINABILITY MASTER PLAN

North Potomac Yard
Alexandria, Virginia




Prepared By:

In Partnership With:

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Introduction and Executive Summary

The North Potomac Yard Small Area Plan "envisions North Potomac Yard as an environmentally and economically sustainable and diverse 21st Century urban, transit-oriented, mixed-use community that is compatible with adjacent neighborhoods." In furtherance of that vision, this Environmental Sustainability Master Plan (ESMP) will serve as the sustainability roadmap for the 20-30 year build out of new development within Potomac Yard By establishing goals, targets for advancement, and a variety of short-term, mid-term and long-term strategies, the ESMP will ensure that Sustainability – environmental, social, and economic – is top of mind for development within North Potomac Yard. By following the guidance in this document, over time, North Potomac Yard is poised to achieve a high level of positive impact in all three areas.

Figure 1. North Potomac Yard aerial photo

Consistent with the Small Area Plan recommendations, the ESMP focuses on a path to "strive to achieve carbon neutrality by 2040 and to strive to achieve carbon neutral buildings by 2030." In addition to addressing this ambitious goal for carbon, the Plan equitably addresses all areas of sustainability, including site, waste, water, health and wellness, and resilience. North Potomac Yard will demonstrate environmental leadership through the consideration and implementation of various strategies listed in the sections below. This plan is a guide for development, proposing possible pathways to achieve sustainability and should not be interpreted as a prescriptive list of requirements, as one size does not fit all and different buildings may incorporate different strategies from the toolkit while working together toward the same sustainability goals.

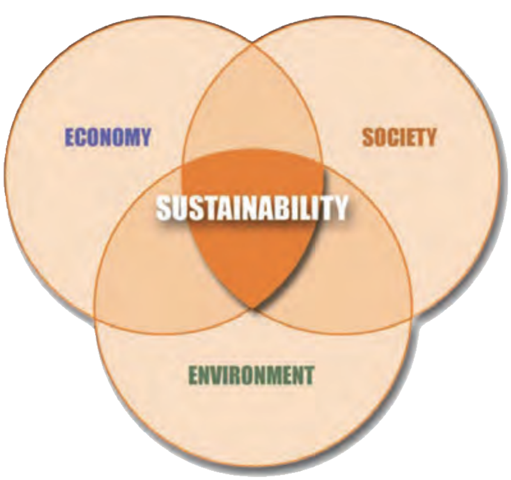


Figure 2. Sustainability has three foundations: economic, social, and environmental

Project Description

North Potomac Yard contains approximately 64 acres of retail and surface parking lots and is located along Route 1 in the northeastern section of the City just south of Four Mile Run. The western portion of the site consists of a suburban-style, surface-parked shopping center anchored by major retailers and restaurants. The eastern portion of the site consists of a surface parked movie theater, flanked by a stormwater management pond to the north and one to the south.

The proposed redevelopment of North Potomac Yard envisions an urban, mixed-use, transit-oriented development that will include office, residential, academic, hotel, entertainment, retail, and restaurant uses. New infrastructure, including major utilities, streets, sidewalks, streetscape, bicycle facilities, and public parks and publicly accessible, open spaces will be included throughout the project. The 64-acre area within North Potomac Yard is anticipated to be redeveloped over time in phases as detailed below:

Figure 3. University of Massachusetts, Amherst

Phase 1 is located on the east side of Potomac Avenue, contains approximately 19 acres, and is currently improved with and a movie theater, associated surface parking lot, and two stormwater management ponds. The current concept for Phase 1 includes a mixture of office buildings, multifamily residential buildings, academic buildings, and ground floor retail and restaurants. New public parks and private and publicly accessible open spaces will also be created. Anchored on the southern end by the new Potomac Yard Metrorail station, Phase 1 will also be the new home of Virginia Tech's Innovation Campus, a magnet for leading tech talent, research, and education with cutting-edge research and development facilities.

Phase 2 is located on the west side of Potomac Avenue, contains approximately 45 acres and is currently improved with a shopping center and associated surface parking lot. Phase 2 is planned to include additional office buildings, multifamily residential buildings, academic buildings, a hotel and ground floor retail and restaurants. The continuation of the Phase I open space, vehicular, bicycle, and pedestrian network, plus the addition of a dedicated Bus Rapid Transit route, will provide the framework for the development blocks in Phase 2. Due to the large amount of land in Phase 2, it is likely to be broken down into additional smaller phases over time.

ESMP Phasing

The ESMP is a living document that will guide all phases of development in North Potomac Yard. As such, it is designed to be revisited and revised over time with each new phase to capture the latest and greatest, economically viable, strategies for advancing sustainability. This ESMP is currently providing real-time guidance for Phase 1 conceptual designs and development planning to address goals and implement strategies within the toolkit identified in the ESMP on both a site-wide and individual building level.

Synergies and Structure

The ESMP builds upon City of Alexandria standards and policies, striving to exceed code and recommending innovative strategies where they are market-feasible and have the ability to create impactful change. Some key references and standards include the City of Alexandria's:

- North Potomac Yard Small Area Plan
- Environmental Action Plan 2040 (EAP 2040)
- Green Building Policy
- North Potomac Yard CDD conditions
- Vision Zero Action Plan
- Landscape Guidelines
- Open Space Master Plan
- NPY Water Management Master Plan
- Solid Waste Management Plan
- Chesapeake Bay Action Plan
- Stormwater Management Master Plan

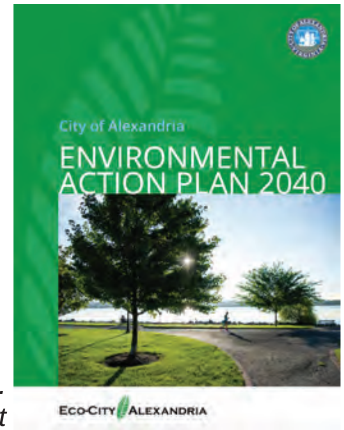


Figure 4.
EAP 2040 Report

The sections, goals, and strategies in this document apply neighborhood-wide, to all phases of development in North Potomac Yard. While some strategies are specific to building-level scale, the strategies build upon one another to create a toolkit that addresses the entire district. Other strategies are enacted on a larger, site-wide scale. These strategies layer over the building-level tools to provide a cohesive framework of sustainability. Some strategies can be found in multiple sections because their impact spans multiple priority areas. For example, habitat restoration and native vegetation protection are Site-related strategies that also impact Resiliency, and reduce the need for potable Water use.

This document loosely follows the EAP 2040 structure, recategorizing priority areas in a way that applies to NPY's unique site and development conditions. The **Carbon** chapter includes topics relating to climate change, energy, transportation and outdoor air quality. **Site** contains information related to land use, open space, and site water resources, while the **Water** chapter discusses indoor water resources and the reuse of site water. The **Waste** section includes solid waste, including waste generated through construction practices. **Health & Wellness** includes indoor air quality, and green building, environmental health, and education/outreach are sprinkled throughout each chapter. The **Resilience** section discusses how infrastructure can be designed to promote district-wide climate change resilience.

Overarching Goals

The ESMP's overarching goals are consistent with the North Potomac Yard Small Area Plan, the Green Building Policy, and the EAP 2040. North Potomac Yard will incorporate the toolkit of strategies geared towards achieving the various goals within each area of sustainability. Advancement in sustainability can be achieved through a combination of approaches:

- Meeting code thresholds in ways that are environmentally preferable as opposed to standard practice;

- Meeting performance-based thresholds rather than meeting prescriptive code thresholds; looking at the weighted value and "sum of the parts" in lieu of traditional incremental requirements; and

- Laying the groundwork now through a combination of standard practices in order to implement future innovative strategies.

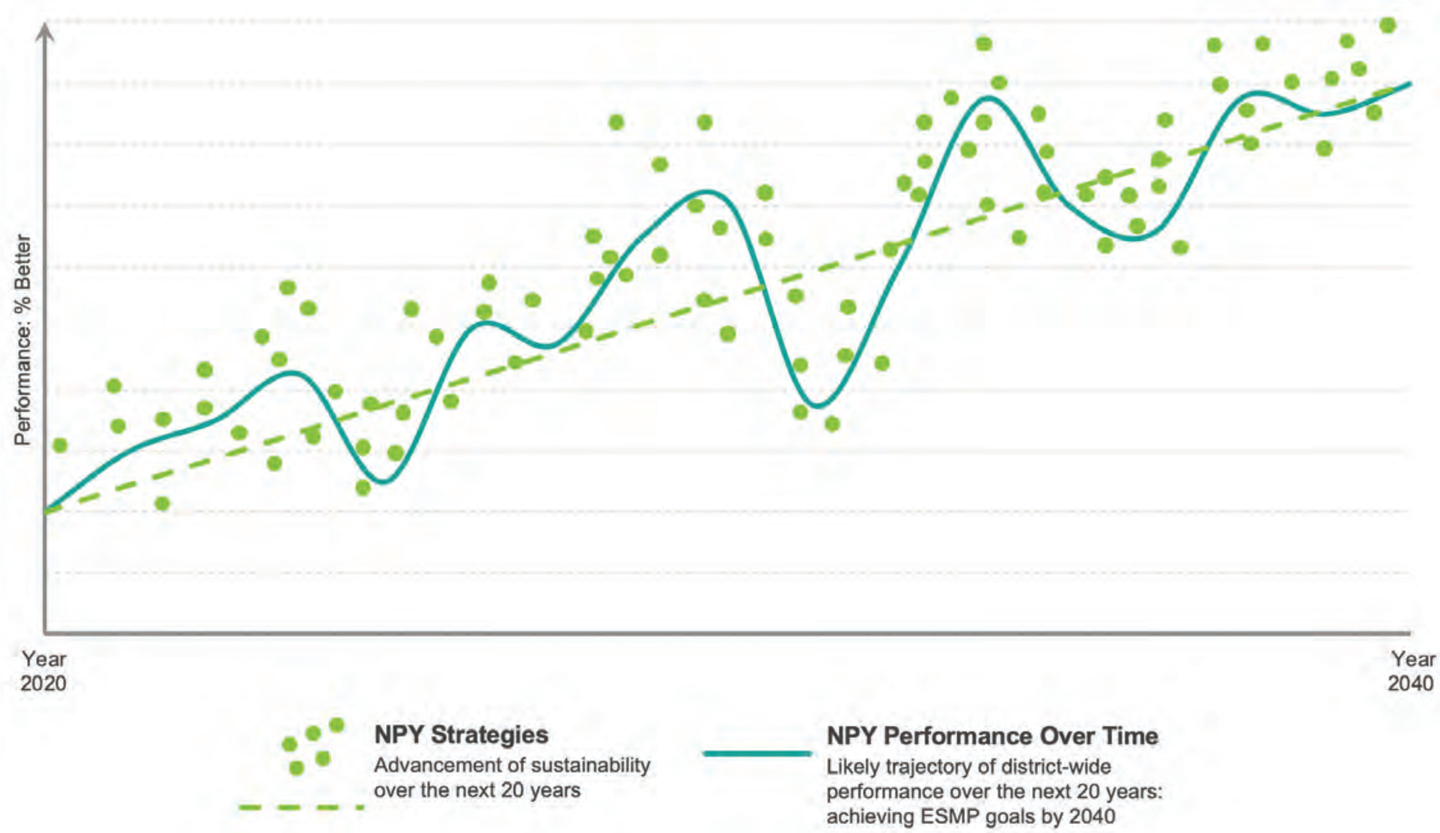


Figure 5. North Potomac Yard Performance Through 2040

Building upon the success the City of Alexandria has had in reducing per capita emissions by roughly 22% since 2005[1], North Potomac Yard will also aim to reduce per capita CO_2 emissions by using available carbon footprint calculators that focus on primary sources of CO_2 emissions such as buildings, solid waste, and transportation. The calculators will be run for each building in the design phase for comparative data use. Multifamily residential energy usage will be tracked after occupancy through mechanisms such as ENERGY STAR Benchmarking.

Sustainability is Top-of-Mind

The ESMP will influence and set the tone and direction for the overall design strategy in each Phase of development. The following pages outline approximately 325 strategies to guide North Potomac Yard toward environmental sustainability and carbon neutrality by 2040. Accordingly, the toolkit established by the ESMP will continue to drive detailed discussions with the architectural, landscape, and civil design teams beginning at early concept design of each phase of the project.

Attached as Appendix A is a Sustainability Strategy Matrix that lists site-wide and block-level approaches to sustainability for Phase 1. A similar exercise will be conducted for future phases of development during their conceptual design development.

Of the 118 strategies identified, 110 (93%) are being explored as part of Phase 1 and 79 (67%) are District-Wide			
Category Strategies	District-Wide Strategies: Included	District-Wide Strategies: Possible	District-Wide Strategies: Under Investigation
Site: 25	17	4	2
Waste: 9	3	2	1
Water: 10	4	2	1
Carbon: 41	13	7	5
Health & Wellness: 19	9	2	3
Resilience: 6	1	2	1

Table 1. District-Wide Phase 1 Sustainability Strategies

1. “Climate Change,” City of Alexandria, www.alexandriava.gov/tes/eco-city

Targets for Advancement of Sustainability

Positive environmental impacts can be realized by implementing the strategies within the toolkit outlined in this plan. In order to ensure progress toward achieving positive impact, North Potomac Yard will gear identified strategies to achieve an increasing level of performance over time across critical impact categories in alignment with the ESMP Goals.

Topic	Categories	Definition	Short-Term (0-5 years)	Mid-Term (Projected: 5-10 years)	Long-Term (Projected: 10-20 years)
Carbon	Operational	% annual operational energy savings	15%	20%	30%
Carbon	Embodied	% reduction in carbon emmissions (structural)	10%	15%	25%
Carbon	Renewables	% on-site net annual production	1%	5%	10%
Carbon	Transportation	% of non-personal auto trips generated	40%	60%	65%
Carbon	Offsets	% offset with RECs, PPAs, or carbon offsets	30%	20%	10%
Water	Potable Water	% reduction in potable water use (fixtures)	20%	30%	40%
Water	Irrigation	% reduction in potable water use (irrigation)	20%	50%	75%
Water	Rainwater	% volume of impervious roof surface stormwater harvested for re-use	5%	10%	15%
Waste	Construction	% reduction in waste (materials & diversion)	50%	65%	75%
Waste	Consumables	% reduction in on-going waste (operations)	15%	25%	35%
Site	Open Space	% of site established for open space	20%	30%	40%
Site	Heat Island	% of grade-level and above-grade coverage	25%	50%	90%
Site	SWM Treatment	% reduction in phosphorous	40%	50%	60%
Site	SWM Volume	% runoff volume managed on site	25%	35%	50%
Site	Tree Canopy	% of tree canopy coverage on site	25%	30%	40%
Site	Green Roof	% of roof allocated for vegetation	25%	30%	40%

Table 2. Summary of NPY ESMP Targets through 2040

- Development Special Use Permits approved 0-5 years from 2020 will target the Short-Term column.
- Development Special Use Permits approved 5-10 years from 2020 will target the Mid-Term column.
- Development Special Use Permits approved 10-20 years from 2020 will target the Long-Term column.

These targets, written with the EAP 2040 benchmarks in mind, will be reevaluated as time passes and future Phases begin design. The (projected) Mid- and Long-Term targets are theoretical and will be revisited and recalibrated based on emerging technologies, economic viability, unforeseen market factors, and evolving codes when future applications are submitted.

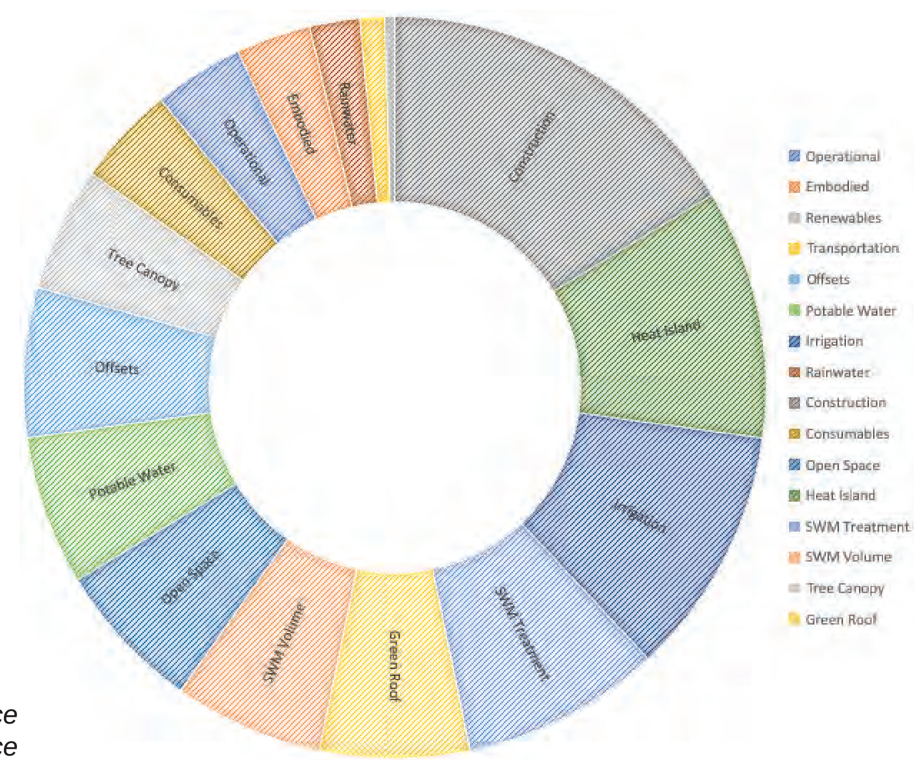


Figure 6. NPY Sustainable Performance Above Standard Practice

Green Building and LEED

The Small Area Plan recommends that the area-wide sustainability be provided through LEED-ND Silver or comparable certification. LEED for Neighborhood Development (LEED-ND) was engineered to inspire and help create more sustainable, well-connected neighborhoods. It looks beyond the building scale to consider entire communities. It applies to new land development projects or redevelopment projects containing residential uses, nonresidential uses, or a mix. Projects can be certified at any stage of the development process: in the design development phase all the way to substantial completion of construction.

The rating system provides a framework and accountability mechanism for developing a comprehensive sustainability plan for large-scale mixed-use developments. Since the rating system considers a district-wide development comprised of multiple buildings, it results in a well-balanced community that energizes itself from within. Strategies are grouped under three primary headings that focus on creating a vibrant sense of place that has diverse offerings, is connected to the community, reduces its environmental impact, and preserves resources. These categories and credit characteristics are defined below.[2]

- Smart Location & Linkage (SLL) Smart, Conserve, Affordable Housing near public transportation, Jobs, Site, Habitat
- Neighborhood Pattern & Design (NPD) Connect, Public, Mixed-Use, Educate
- Green Infrastructure & Building (GIB) Resource Optimization, Historic
- Innovation & Regional Priority Exemplary Performance, Regional, Innovative

Figure 7. CityCentre Plaza, Houston, TX

The North Potomac Yard development will pursue LEED v4 ND Silver Certification. The development will leverage strategies from the rating system and work to incorporate the elements throughout each phase of the project. The following strategies, which are in line with sustainability goals for the development, are targeted in order to achieve maximum impact and cohesion throughout the project:

- Retain rainwater on site by managing the 85th percentile storm event. Incorporate bioretention and vegetative roofs with optimized retention layers; consider rainwater re-use for process water make-up water.
- Optimize transportation options by providing bicycle maintenance equipment, implementing smart wayfinding technologies, installing EV charging stations, and locating covered and comfortable transit shelters.
- Implement a robust waste management system, providing means for storing and recycling hazardous and electronic waste
- Install high-efficiency infrastructure including street lighting, traffic lights, and water/ wastewater pumps

2. LEED for Neighborhood Development, US Green Building Council; www.usgbc.org/credits

The Small Area Plan also recommends that buildings achieve LEED Silver or comparable certification, or whatever City Green Building Policy is in effect. The most recent update to the City's Green Building Policy was adopted by City Council in 2019, following a robust process, including a task force comprised of representatives of a variety of constituencies assembled to develop consensus-based recommendations. The Policy will be reviewed and revised over time, and future phases of development within North Potomac Yard will develop in accordance with the City's Policy in effect at that time.

Pairing the rigor of the LEED v4 ND Silver Certification with Alexandria's 2019 Green Building Policy results in equitable contribution across the development. It ensures no single part of the neighborhood carries the bulk of the LEED performance effort and that all levels of impact and performance are addressed equitably district wide. As part of the development conditions, all office buildings will achieve at minimum LEED BD+C v4: Core and Shell at the Silver level, all multi-family buildings will achieve LEED at the Certified level with a goal of Silver certification (or higher), and all other uses will meet Alexandria's Green Building Policy requirements.

An example LEED ND Scorecard, with a potential path to certification, is provided in Appendix B. Targeted strategies will be fully evaluated at each phase of development, being mindful of impact, technology, demand, sustainability as well as overall developmental goals, conditions, and requirements.

Timeline-Based Sustainable Strategies

There are many layers, levels, and scales of complexity involved in the creation of a high-performance sustainable neighborhood within a phasing strategy over a twenty-plus year timeframe. A goal of the project is to create a site that has capacity for change and is ahead of the curve in order to adapt alongside development cycles. This will ensure maximum impact and flexibility given changes in market conditions and building codes, evolution in technology, synergies between strategies, compounding effect, and other factors. Strategies can have targets that define their level of success at key points in time. Some lend themselves more to metrics-based tracking, whereas others are more qualitative in nature. All strategies identified in the ESMP, whether Short-, Mid-, or Long-Term, will be evaluated for cost-effectiveness and market viability at the time of design and anticipated construction.

Identifying strategies that are timeline-based ensures that progress continues, and sustainability is "top of mind" at each phase of development. It also celebrates building design and neighborhood character through the lens of sustainability from the very beginning. There are multiple ways to define the time component of a strategy:

- parallel with code evolution;
- when the strategy is implemented or constructed;
- when a strategy reaches critical mass and its full impact is realized;
- set, objective increments of years.

For the purposes of this ESMP, sustainability strategies are categorized into Short-, Mid-, and Long-Term opportunities.

Figure 8. Active roof space

A **Short-Term** sustainable strategy is one that:

- is a readily available technology with proven performance;
- is incorporated when the first building comes online;
- is considered in design of buildings approved within 0 - 5 years of adoption of the ESMP; and
- can be a unique and distinct component of a Mid- or Long-Term strategy.

A **Mid-Term** sustainable strategy is one that:

- a fringe technology today but could become more widely adopted;
- is incorporated after the first building comes online;
- is considered in design of buildings approved within 5 - 10 years of adoption of the ESMP;
- may be considered for incorporation into future phases of development, pending cost-effectiveness and market viability; and
- can build upon a collection of Short-Term strategies.

A **Long-Term** sustainable strategy is one that:

- is more aspirational in nature;
- anticipates and provides near-term accommodations for future technologies, best practices, and infrastructure;
- is considered in design of buildings approved within 10 - 20 years after delivery of the first phase of development;
- may be considered for incorporation into future phases of development, pending cost-effectiveness and market viability; and
- can build upon a collection of Short- and Mid-Term strategies.

The following sections of this ESMP go into more detail on the combination of sustainable strategies that fit within these timeline-based categories. They have been studied and developed in order to achieve the goals of maximum impact, feasibility of implementation, and market viability. Not every strategy is applicable to every phase or building. Goals strategies, and targets listed in this document will be reevaluated at each phase of development, and will evolve as technology, demand, and feasibility change.

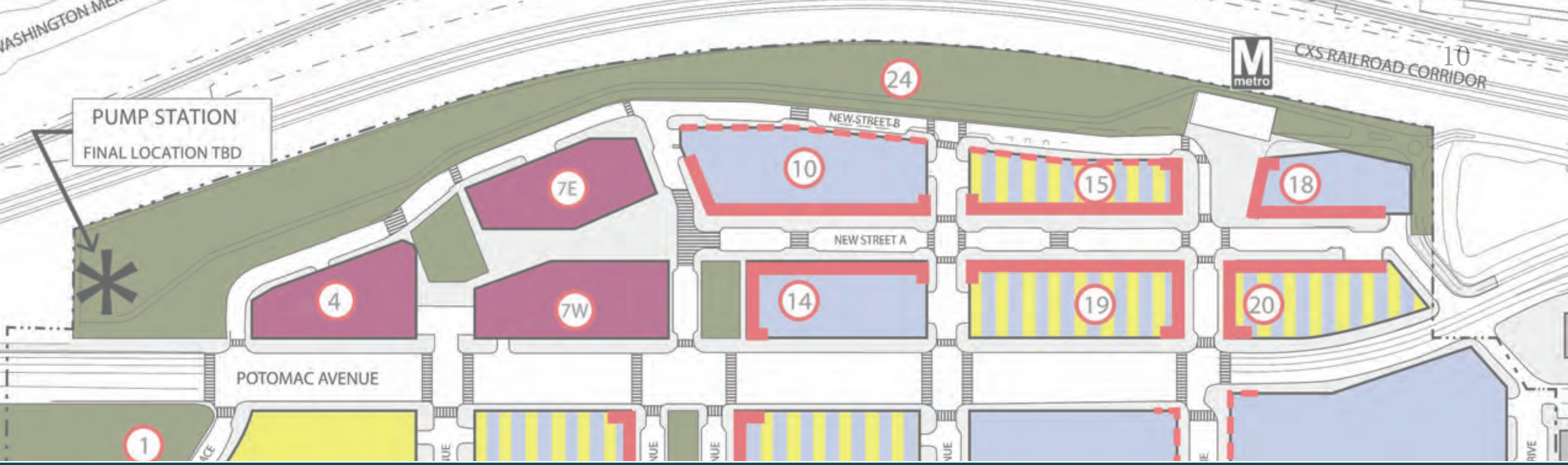
Throughout this document you will see the following icons below to help orient the reader to what strategies and tools are considered Short-, Mid-, and Long-term.

Short-Term Tools

Mid-Term Tools

Long-Term Tools

SITE



Site

BACKGROUND

This section provides targets for achieving a sustainable site through the recognition of landscape as a core component of North Potomac Yard (NPY), vital to its overall environmental success. “Site” refers to the exterior fabric of the entire NPY district, to include open spaces, rights-of-ways, vegetated areas, and the layout and linkages of buildings. A sustainable site is one that:

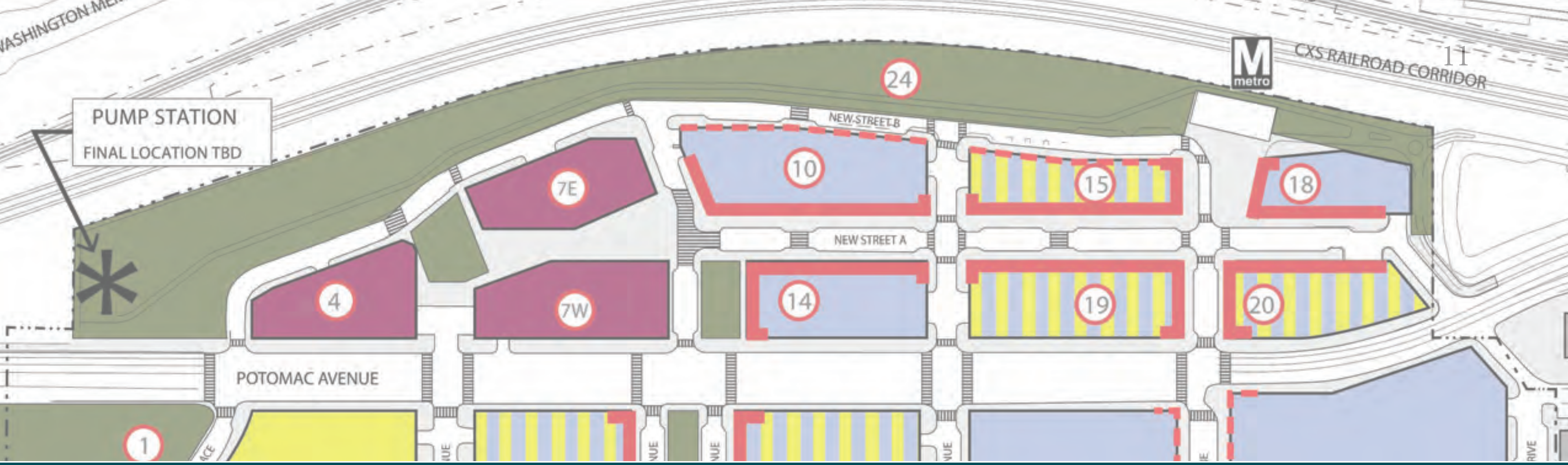
- prioritizes ecosystem services;
- views precipitation as a resource rather than a waste product;
- protects waterbodies and ecological communities;
- preserves existing and/or creates new habitat and biodiversity;
- provides gathering spaces that are accessible, equitable, functional, and fun;
- celebrates the local and regional environmental fabric;
- balances flora and fauna with programmatic needs; and
- provides a mix of land uses and transit-oriented development.

Incorporating site sustainability principles as core priorities at project inception, as is being done through this ESMP, guides the evolution of the design throughout build-out of all phases. Employing site-sensitive and low-impact design techniques, construction best practices, and environmentally-sensitive ongoing operations will help NPY achieve a high level of sustainable site performance over time.

Building-scale strategies combine across the site and then across the entire NPY district, linking to larger City and regional ecosystems. Environmentally-sensitive designs- such as providing tree canopy and habitat linkages throughout the site- result in a web of infrastructure that is critical for species viability, natural resource function, and human wellness. Thoughtful and sustainable development of NPY ensures that it is more resilient to withstand the changing climate.

Figure 9. (Left) Marine Gateway open space

Figure 10. (Right) Waterway Square District, Houston, TX



Stormwater I-1

DEFINITION

Stormwater management (SWM) is the effort to reduce the quantity, and improve the quality, of runoff due to rain, snow, and other precipitation events. As storm events become more irregular and unpredictable due to climate change, the need to manage stormwater effectively will also increase. Current development standards lead to increased water runoff due to the replacement of natural groundcover with impervious surfaces. Since these surfaces prevent water from naturally filtering into the ground, water that falls here travels down-grade as runoff. If there is no SWM onsite, water will run offsite, collecting all chemicals and pollutants in its path, and into local waterways or the municipal water system. Municipal systems, including combined sewer systems, are not typically designed to handle such large volumes of water resulting from significant storm events, and are certainly not capable of handling the increased volume of water that is predicted due to climate change. Implementing successful SWM practices now is essential to the health of our environment and the success of our municipal water system in the future. Treating rainwater as a resource, rather than a waste product, expands the possibilities surrounding its management. The neighborhood's natural hydrology is considered as water is managed as close to the "source" as possible.

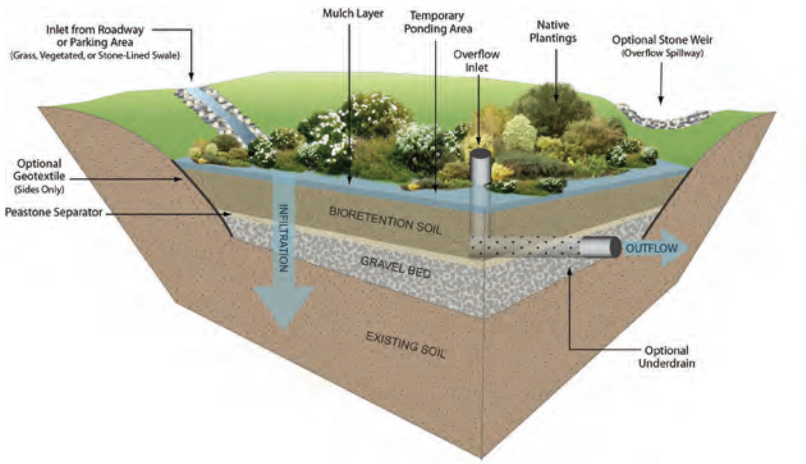


Figure 11. Bioretention cross section

GOALS

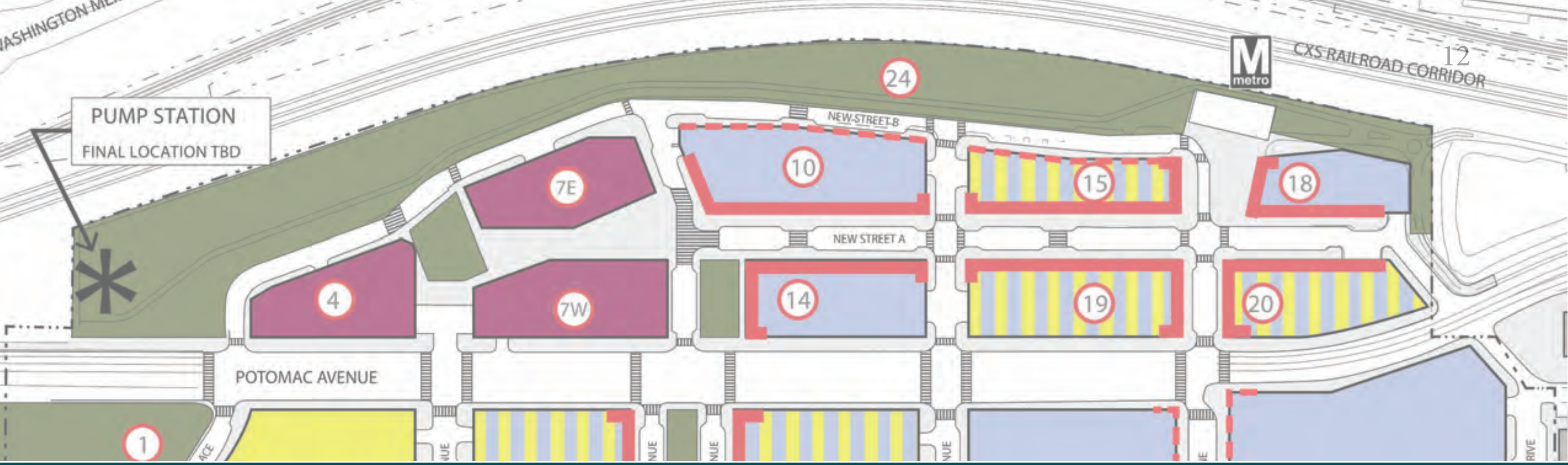
1. Manage stormwater onsite, to the extent possible.
2. Reduce the development impact on the municipal water system.
3. Design sites that are resilient to changing environmental conditions.
4. Implement SWM strategies to manage high percentile storm events.
5. Become an example for SWM for future projects.
6. Educate the public on the importance of SWM features implemented at NPY.

TOOLKIT

Short-Term

- Replace impervious surfaces with open green space and vegetation to increase stormwater percolation, resulting in filtration and groundwater recharge.
- Use permeable hardscape systems- such as pervious concrete, asphalt, and interlocking pavers- to allow stormwater infiltration close to its source.

SHORT-TERM



Stormwater I-1

TOOLKIT

Short-Term cont.

- Simple disconnection: collect stormwater from impervious surfaces (such as non-vegetated roof space) through drains below pavement. Drains may connect to water collection areas or pervious vegetated spaces.
- Reuse collected stormwater for non-potable water sources- such as irrigation, cooling towers, and toilet/urinal flushing- to reduce burden on the municipal water system.
- In lieu of piping for conveyance, construct bio-swales to mimic the natural drainage of the NPY watershed.
- Utilize erosion and sedimentation control practices that exceed the minimum standards summarized in the USDA's Guidance for Use of Erosion and Sediment Control Measures with Construction Activity[3].
- Install extensive and intensive vegetated roofs on at least 25% of the total roof area in the NPY district.

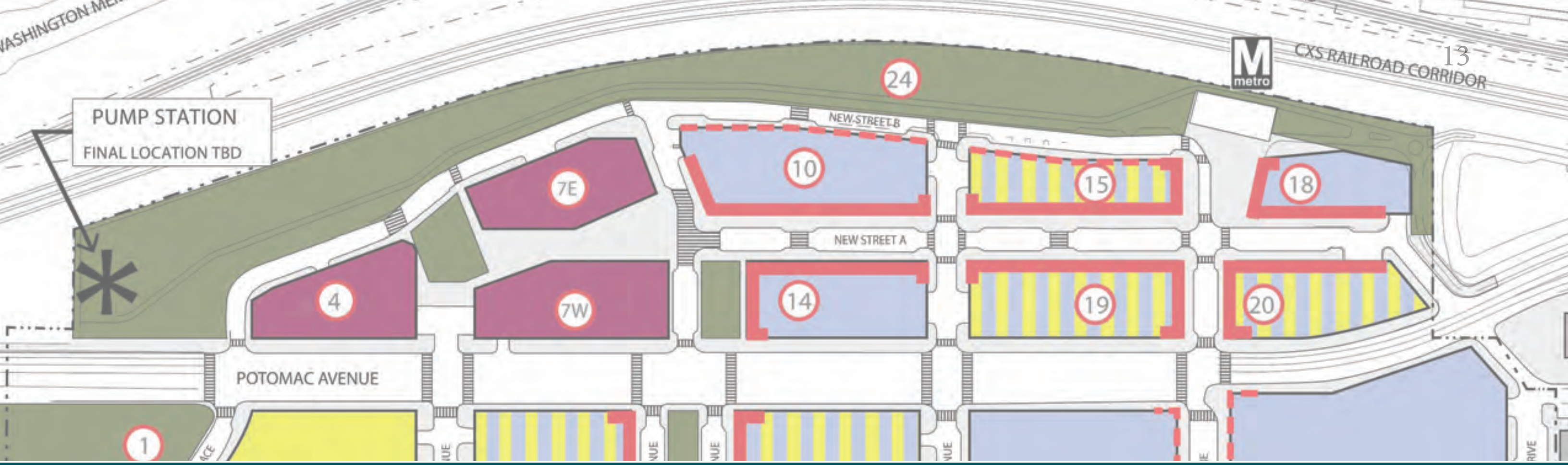
Mid-Term

- Implement monitoring activities to ensure the success of the SWM system. Water quality testing, inlet/ outlet function, bioretention plant health, runoff and erosion reduction over time, etc. are all indicators of success.
- Develop a policy to ensure regular maintenance of hardscape surfaces to reduce contaminants conveyed by runoff.
- Phase out or reduce chemical treatment of vegetation, snow/ice, and pests, and investigate the use of more natural products where complete phase-out is not possible.

Long-Term

- As new technologies are developed and additional development is constructed in the NPY district, upgrade the SWM system to include additional facilities (where appropriate) and replace facilities that may not be as high-performing as they were at installation.
- Evaluate the performance of constructed block-level green infrastructure to inform adaptive design. Consider any changes in the percentile storm event the project should be managing, and develop strategies to address increasing volume of stormwater due to climate change.
- Consider installing "purple roof" systems that incorporate substantial stormwater detention beyond what extensive and intensive green roofs are capable of.

3. USDA NRCS, https://directives.sc.egov.usda.gov/



Open Space I-2

DEFINITION

One of the most effective ways to improve occupant well-being, is to provide activated open-space. Open space can encourage both social and physical well-being for those that have access to well-designed outdoor spaces which supports the wellness and sustainability goals for NPY.

GOALS

1. Incorporate open space that encourages both social and physical well-being.
2. Integrate site design to include active and healthy outdoor space.
3. Encourage social and physical activity through well-designed outdoor space.
4. Adaptable outdoor spaces to meet the needs of the users.

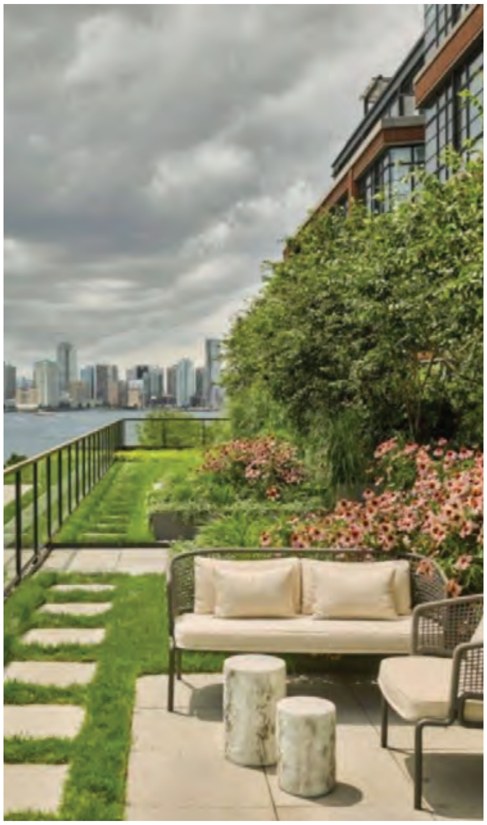


Figure 12. Rooftop open space, 150 Charles Street in New York City.

TOOLKIT

Short-Term

- Design for walkability through a network of sidewalks and walking trails.
- Design open space areas with the ability to accommodate a variety of activities.
- Include accessible vegetation within parks and along sidewalks.
- Include infrastructure that promotes social and physical activity, such as play areas, tables, and seating areas.
- Design to promote community with social and civic gathering spaces.
- Design inclusive and diverse spaces that work for all.
- Activate roof areas as accessible open spaces for building occupants (using both vegetation and hardscape).

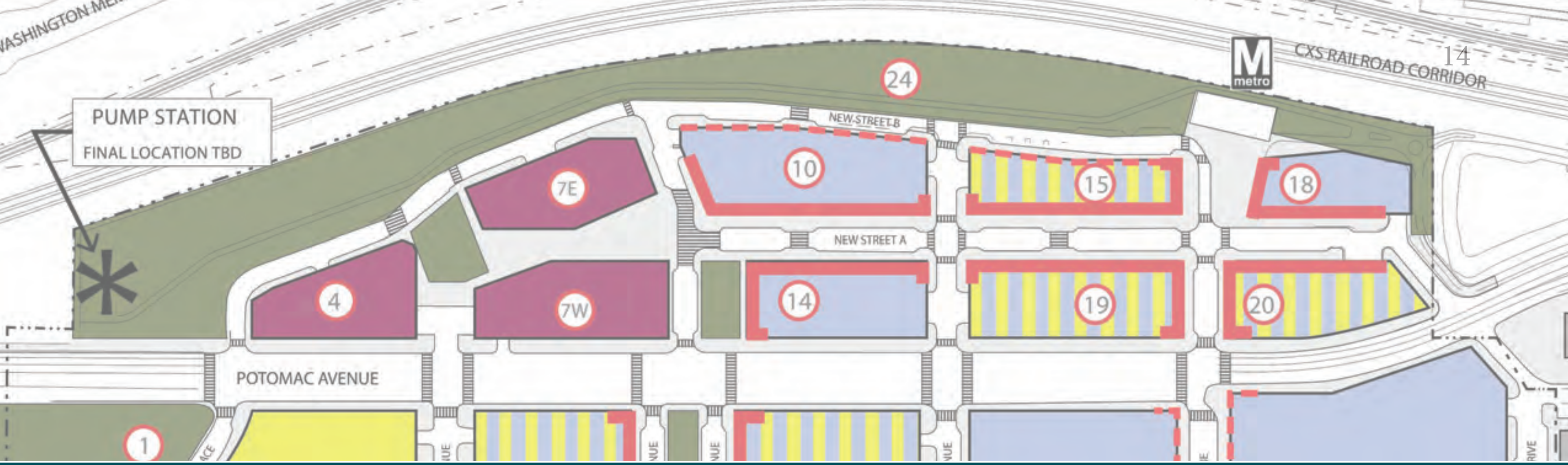
Mid-Term

- Develop annual schedule of events (dual use of public streets)
- Explore urban gardens for promoting local food production.

Long-Term

- Connect to, and leverage, a larger network of parks in future phases.

SHORT-TERM MID-TERM LONG-TERM



Habitat I-3

DEFINITION

Preserving and restoring natural habitats is important for reducing the environmental impacts of development. The more we build, the less natural habitat remains for local ecosystems to thrive. By incorporating habitat creation into building or neighborhood developments, biodiversity in an urban environment will be improved. In the case of NPY the new plan will look to re-energize with more natural cover solutions, where possible, when compared to the current condition.

GOALS

1. Improve habitat creation beyond existing pre-developed condition.
2. Promote human interaction with natural habitat.
3. Utilizing natural and native landscaping to improve biodiversity.
4. Maintaining healthy habitat onsite with regular upkeep.
5. Explore intuitive habitat education for visitors and residents.

Figure 13. Living roof in Thunder Bay, ON

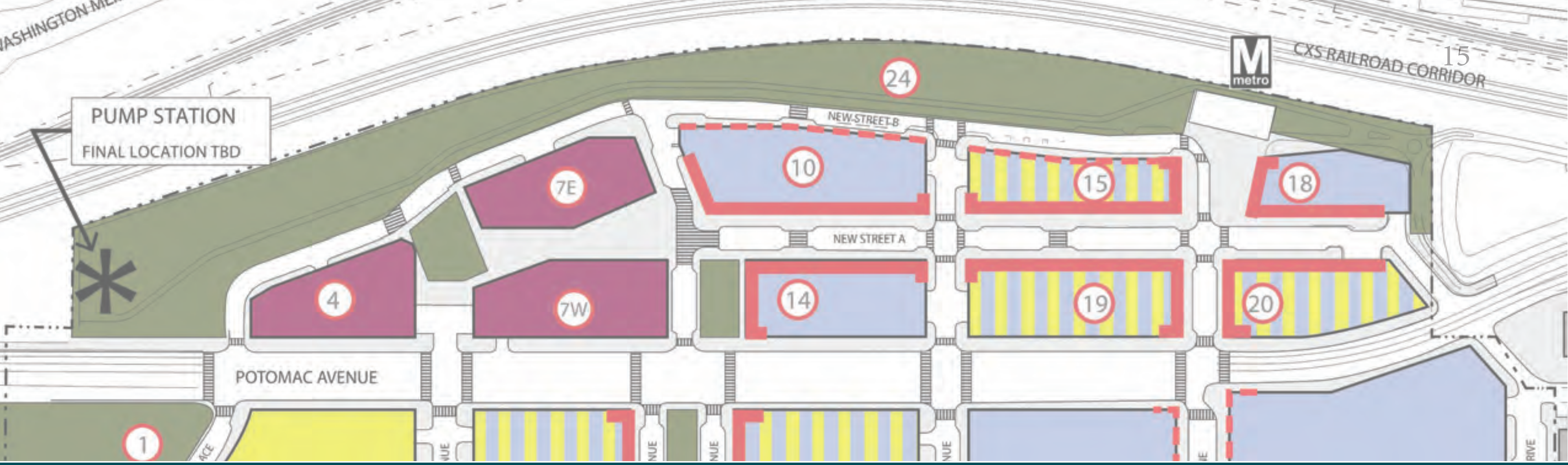
Figure 14. Native plantings, Partners Healthcare Administrative Campus

TOOLKIT

Short-Term

- Consider native and adaptive plantings for the entire site to promote habitat creation and help reduce outdoor water usage.
- Clearly delineate the boundary of any protected habitat areas on plans that are part of the site or facilities maintenance documents.
- Do not use protected habitat areas to store equipment or materials or dispose of waste, whether organic or inorganic.
- Plan for environmental conditions specific to the site (even a native species will not thrive if planted in an inappropriate microclimate).
- Source plants from reputable nurseries that can attest to the plant origins, ideally nursery-propagated specimens that originated in the same ecoregion as the project site.

SHORT-TERM



Habitat I-3

Short-Term (cont'd)

- When specifying adapted vegetation, choose cultivars of native vegetation that are not considered invasive plants or noxious weeds, and that grow reliably well in the project's locality with minimal maintenance, winter protection, pest protection, irrigation, and fertilizer.
- Restore natural slopes where feasible.

Mid-Term

- Monitor habitat areas for invasive species and remove them when they are identified.
- Do not harvest live vegetation, fallen trees, or dead standing trees, unless they pose a danger to human safety or create a fire hazard, or as prescribed by a certified forester for the purposes of advancing habitat protection.
- Consider extensive and/or intensive green roof systems that promote habitat and biodiversity.
- Begin collecting data on site plantings and habitat.

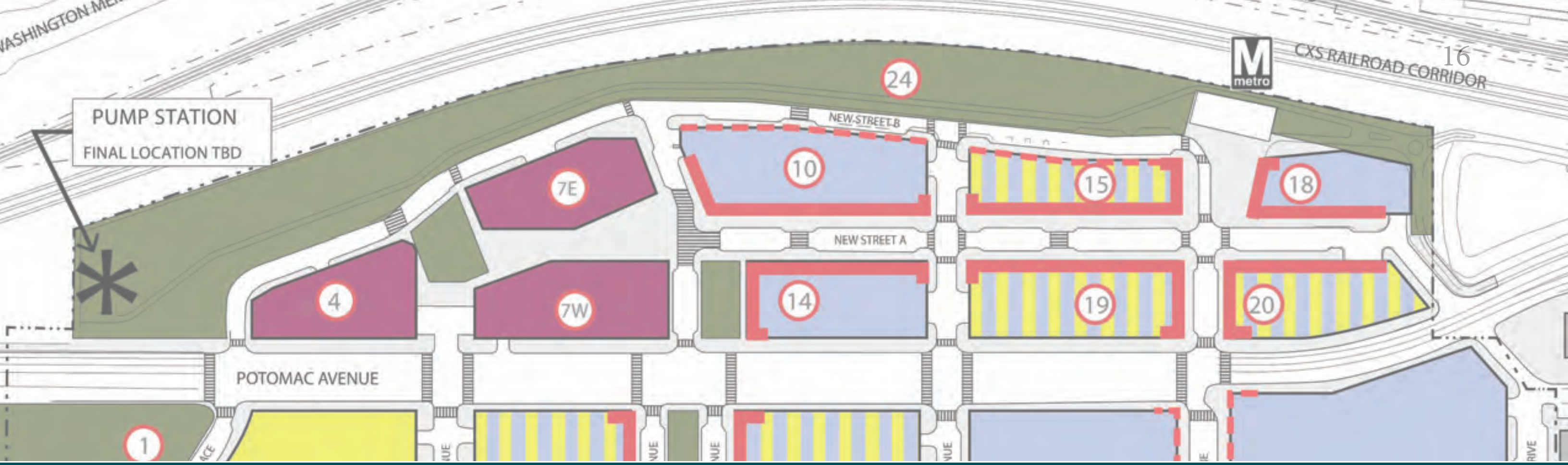
Long-Term

- Establish an adaptive landscaping plan that considers the changing climate.
- Use data collected on site plantings and landscaping to inform future site decisions and development.
- Familiarize the community with the local ecosystem, supporting high impact education through thoughtful open space design and programming (e.g. constructing boardwalks along established riparian buffers and erecting educational signage that describes the services provided by flora and fauna).

Figure 15. (left) Biobasin and native plants

Figure 16. (right) Habitat and water body restoration area

SHORT-TERM **MID-TERM** **LONG-TERM**



Heat Island

I-4

DEFINITION

Passive cooling is a suite of design approaches aimed at controlling and dissipating heat gain of surfaces exposed to solar radiation, thereby minimizing the need for active approaches. These approaches introduce ways of offsetting excessive absorption of solar energy within large urban and exurban core areas that hold dense concentrations of concrete, steel, and asphalt. This section looks at Heat Island Reduction and how it can be implemented broadly within the context of NPY. Borrowing concepts of green infrastructure, this strategy attempts to replicate much of the natural world through a design of materials and methods into the built environment of the project site. Using a joint approach of natural materials and technological methods, communities are sure to see a reduction in associated issues related to the heat island effect in the form of decreased energy costs, air pollution, and heat-related illness.

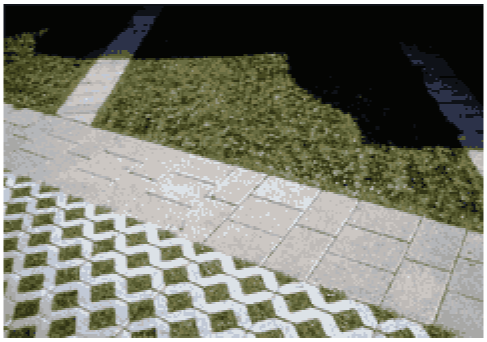


Figure 17. Open-grid and highly-reflective paving

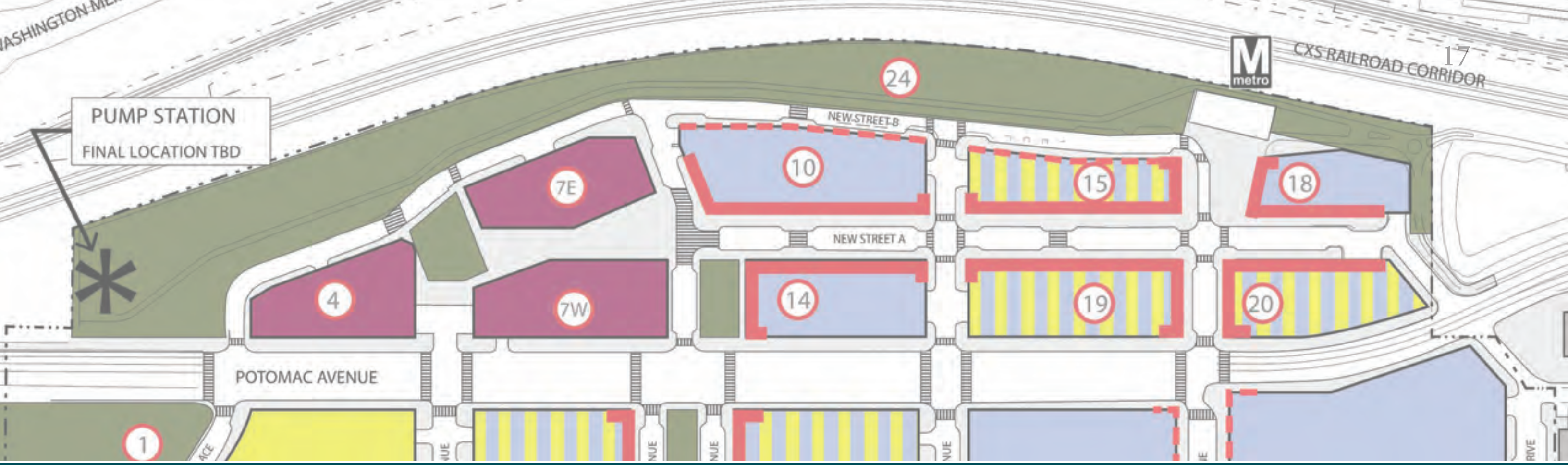
Figure 18. Reducing heat island effects in urban areas.
High Line, New York City

According to a climate study put together by Climate Central[4], the surrounding area of DC experiences a temperature surge of up to 21 degrees (F) during the summer as opposed to surrounding rural areas. Aerial imagery shows Alexandria to be a hot spot tethered to the larger Metropolitan region by a web of roadways with significant thermal mass[5].

GOALS

1. Employ heat island reduction materials and methods with a restorative approach.
2. Increase urban tree canopy, and utilize green roofs to the extent possible.
3. Employ high Solar Reflectance Index (SRI) materials, open grid, and energy generation systems.
4. Restore areas of vulnerable hot spots with vegetation and other structures.
5. Expand corridors for natural air circulation.
6. Use of cool materials with high emissivity and reflectance.
7. Efficient technological approaches that minimize energy release or expenditure.

4. “Hot and Getting Hotter: Heat Islands Cooking U.S. Cities,” Climate Central
5. “Detailed maps of urban heat island effects in Washington, DC, and Baltimore,” NOAA



Heat Island I-4

TOOLKIT

Short-Term

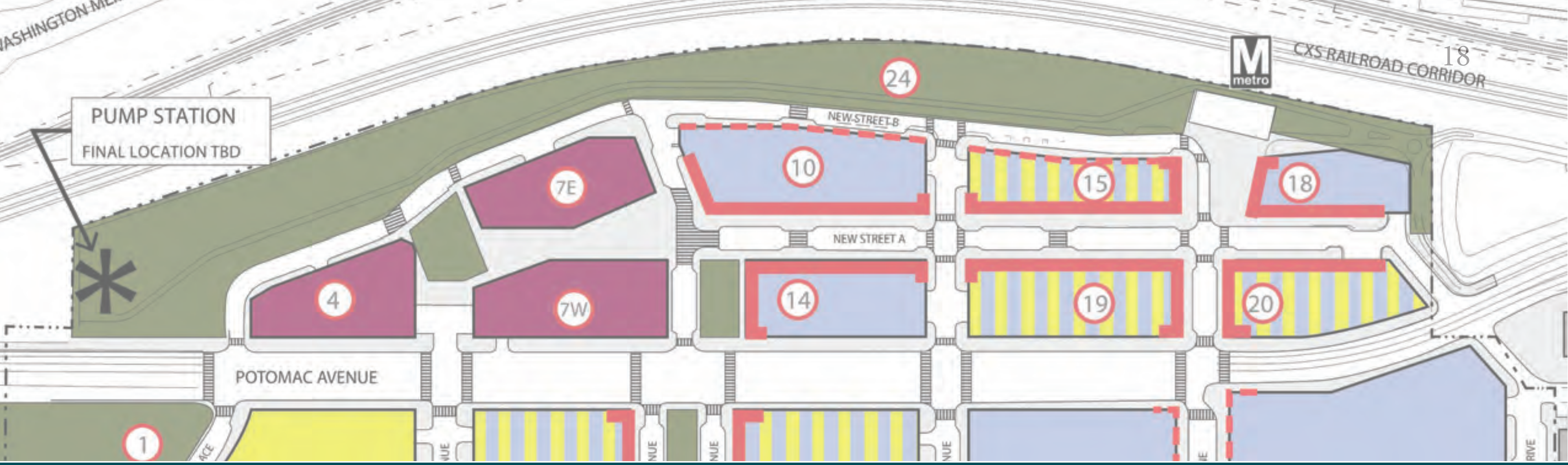
- Protect and increase vegetation through tree cover and plant beds that will aid in shading and evapotranspiration.
- Install extensive and intensive vegetated roofs on at least 25% of the total roof area in the NPY district.
- Use ground-level paving materials with a three-year aged solar reflectance (SR) value of at least 0.28 or an initial SR of 0.33.
- Use roofing materials with an SRI of 39 minimum for steep roofs, and 82 minimum for low-sloped or flat roofs.
- Provide shading structures covered by energy generation systems - such as photovoltaics - that will offset nonrenewable energy use.
- Where feasible, design pavement with open-grid systems that will minimize thermal absorption.
- Integrate heat/energy recovery ventilators that capture waste heat for re-use instead of release into ambient air.

Mid-Term

- Inspect and replace deteriorated hardscape materials that have decreased solar reflectance due to weatherization.
- Regularly maintain landscaped areas to promote healthy development that will contribute to air quality and reduced onsite temperatures.
- Restrict use of lawncare equipment using nonrenewable fuel sources and/or minimize usage on days of low air quality.
- Have in place extensive and intensive vegetated roofs, high-SRI roof materials, high-SR paving, and plant canopy coverage on at least 50% of NPY district (roofs and ground-level combined.

Figure 19. Vegetation and high-reflectance surfaces lower heat gain and create a pleasant environment for people.

SHORT-TERM MID-TERM



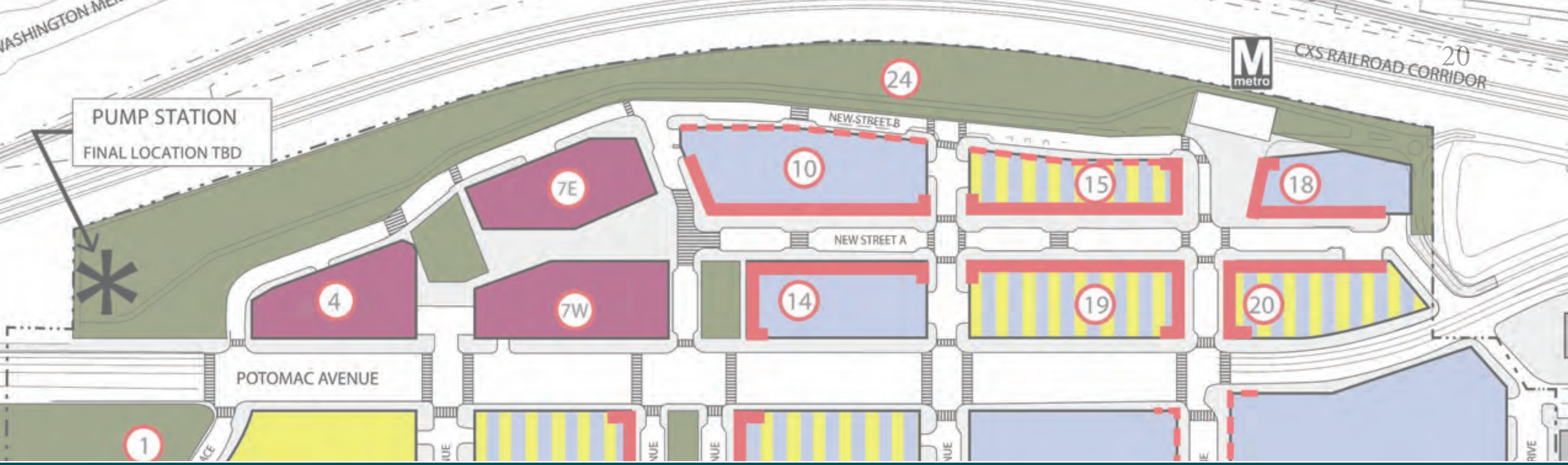
Heat Island

Long-Term

- Continue to reevaluate landscape and hardscape maintenance protocols to ensure the health of mature plants and the reflectance of hardscape materials.
- Have in place extensive and intensive vegetated roofs, high-SRI roof materials, high-SR paving, and plant canopy coverage on at least 90% of NPY district (roofs and ground-level combined).

Figure 20. A reduction in heat island effect can be felt after dark. Lower air and surface temperatures result in more pleasant, usable public open spaces.

Waste



Waste

II

BACKGROUND

Responsibly managing waste on a building and neighborhood-level within NPY is a key goal of the project. Reducing overall waste, achieving a high recycling rate, and offering ample opportunities for occupants to responsibly dispose of their waste is critical in addressing emerging environmental concerns and taking advantage of evolving technologies.

Solid Waste Management is an essential service in any community, and having an efficient system in place has multiple benefits not only to the local community but to the greater region and world. Actions taken to develop a comprehensive solid waste management system that results in the reduction of overall waste will not only have a positive environmental impact but will also result in the reduction of costs and resources required to manage and dispose of solid waste. The City of Alexandria recognizes Solid Waste removal as one of the City's more important regular responsibilities and core services[6]. "Solid waste" is defined as any garbage or discarded material resulting from operations or activities[7].

Construction projects are large generators of waste, and account for one of the main sources of materials that wind up in landfills. Standard practice involves little recycling or reuse of demolition and construction waste, and often the driver of recycling is the ability to recoup money for those materials. The number one priority related to this topic for NPY is reducing the volume generated so that there is less to remove, recycle, or process as waste.

NPY will focus on avoidance, waste minimization, recycling/composting, and reuse initiatives in order to reduce the amount of waste going into landfills. According to the Waste Management Hierarchy,[8] these are the preferred opportunities to achieve a sustainable waste management program therefore reducing the need to dispose of the waste in a landfill.

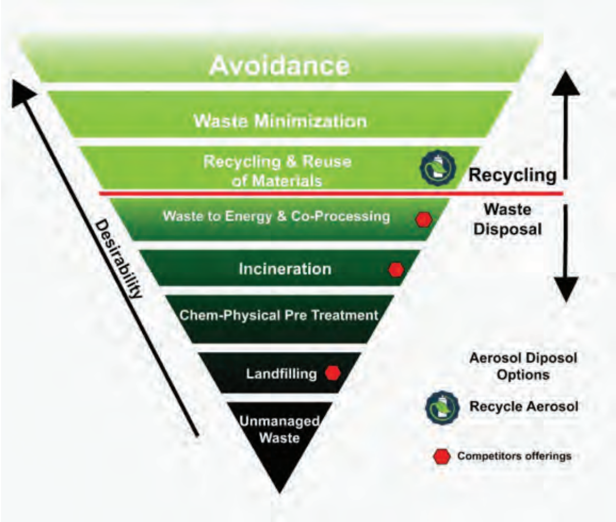
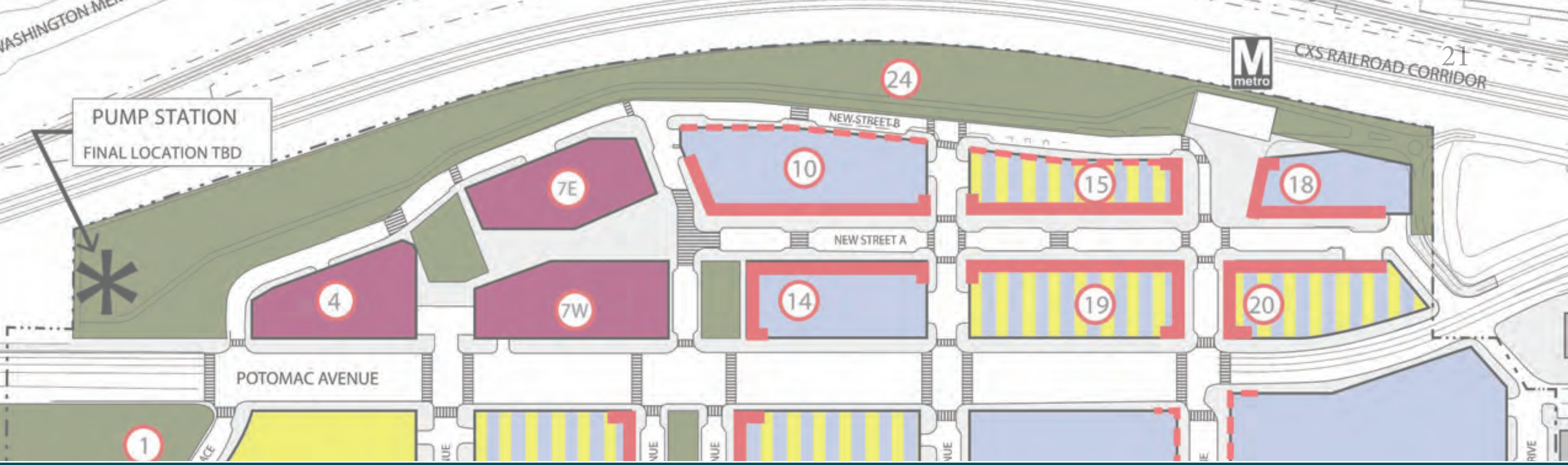


Figure 21. Waste Management Hierarchy (EPA)

Food scraps make up 30% of our waste stream and generate billions of tons of greenhouse gas emissions if not handled carefully[9]. Implementing a robust composting program will provide great benefits to the community as well as reducing the overall waste that has to be sent to the landfill.

6. "Waste Smart – Alexandria's 20-Year Strategic Plan to Sustainable Recover Resources," City of Alexandria
7. "Criteria for the Definition of Solid Waste," US EPA
8. "The Waste Management Hierarchy," US EPA
9. "Food & Organic Recycling," Waste Management



Construction II-1

Definition

Construction waste is identified as materials that originate from demolition, excavation, general construction activities and construction trailer operations. This includes the following specific materials: concrete/asphalt/stone, masonry/brick, drywall/gypsum board, ceramic/porcelain tile, carpet, glass, metal, wood, plastic, cardboard/paper and food waste. Construction waste places an increased burden on our ecosystem due to our inability to process and safely eliminate that which cannot be recycled thus resulting in more landfills and incineration facilities. According to trends and market research performed by the World Bank, future projections indicate that the amount of solid waste generated from construction will increase to 2.2 billion tons per year by 2025[10].

Figure 22. Demolition waste can be diverted from the landfill in a number of ways.

Figure 23. Separating and labeling waste diversion streams onsite.

GOALS

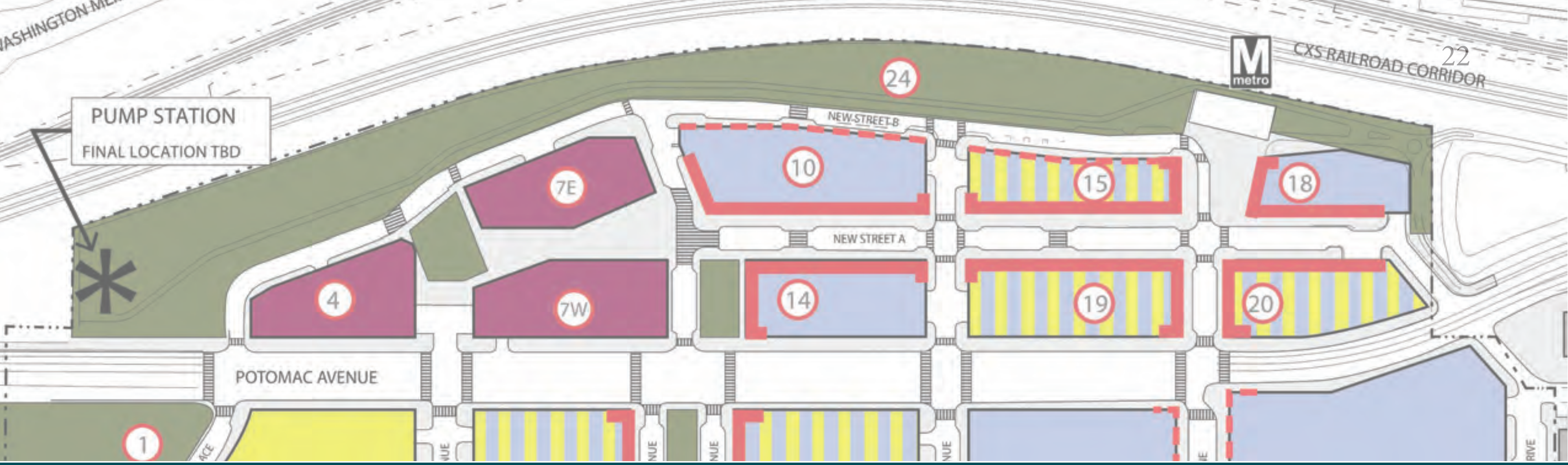
1. Reduce overall waste generated by construction practices.
2. Prioritize innovative alternatives to waste generation.
3. Minimize the environmental impacts of construction trailer and staging area operations.

TOOLKIT

Short-Term

- Establish master site construction waste management plans/ policies.
- Educate and inform all contractors on recycling protocols/ processes identified within the construction waste management plans via submission of plans for record, scheduling of recycling kick-off training and monthly contractor meetings onsite.
- Strive for an overall minimum construction waste diversion rate of 50%.
- Strive for a recycling diversion rate of 100% of all carboard/ paper waste originating from construction trailer operations.
- Establish contractor check-ins and reporting protocols related to waste diversion rates.

10. "What a Waste: An Updated Look into the Future of Solid Waste Management," World Bank, September 2018



Construction II-1

Short-Term cont.

- Explore alternative waste diversion strategies such as buy-backs, closed-loop recycling, and material surplus donation.

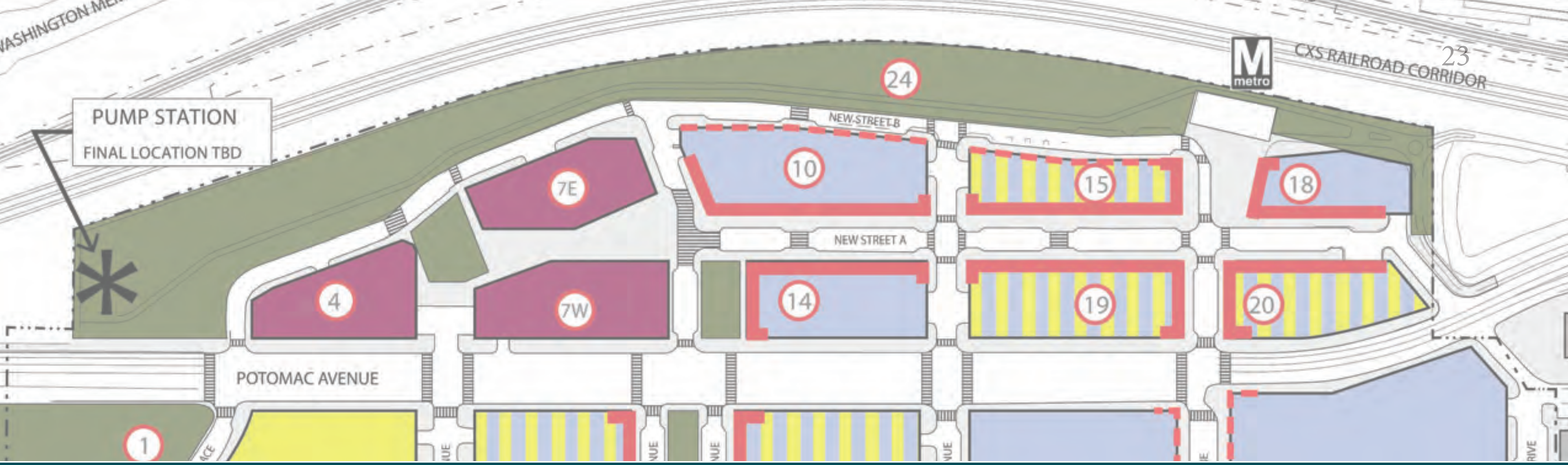
Mid-Term

- Strive for a minimum construction waste diversion rate of 75%.
- Specify disclosure requirements for management of waste streams.
- Explore third-party verification using a verified hauler.
- Compost food waste generated by construction trailer personnel and arrange for pickup by a local composting company for use at municipal or community gardens.

Long-Term

- Strive for a minimum construction waste diversion rate of 90%.
- Pursue Zero-Waste Certification goals related to construction waste.

Figure 24. Separate waste streams ready for recycling



Infrastructure II-2

DEFINITION

Infrastructure waste is identified as waste generated from site activities with scopes of work that include roadways, parking lots, sidewalks, curbs, unit paving, backfill/base/sub-base, water retention tanks/vaults, rainwater piping systems, sanitary sewer piping systems, potable water piping systems, and steam energy distribution systems. The materials that make up these infrastructure types are highly recyclable and mainly include cementitious components, stone, metal and plastic. Due to this, it is critical that we encourage and educate responsible reuse and recycling practices related to these infrastructure scopes of work. NPY is committed to solutions that minimize overall site construction-related waste and its harmful impact on the environment.

Figure 25. Infastructure reuse- Project Divert

Figure 26. Concrete can be crushed and reused for other aplications

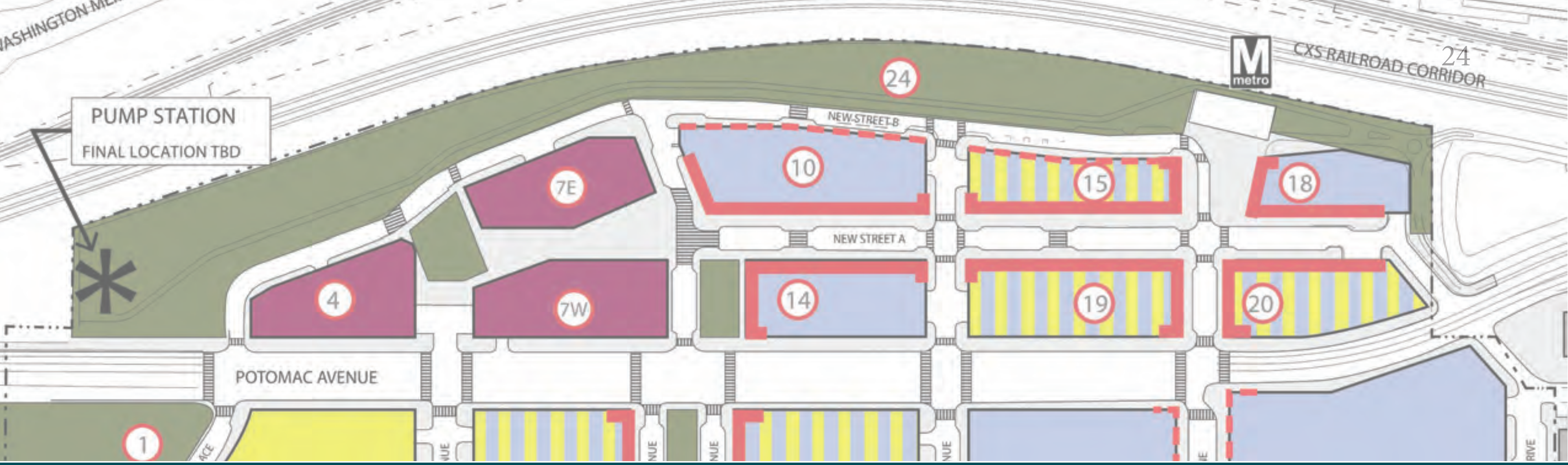
GOALS

1. Reduce the embodied carbon of district-wide site infrastructure.
2. Prioritize the carbon footprint of infrastructure through early planning and collaboration between designers, suppliers, and the construction team.
3. Educate stakeholders on the impacts of infrastructure and the opportunities that exist to make positive change.

TOOLKIT

Short-Term

- Reuse demolished asphalt, concrete, and stone as backfill, base and sub-base materials.
- Strive for the sum of the postconsumer recycled content, on-site reused materials and one-half of the pre-consumer recycled content to constitute at least 50% of the total mass of infrastructure materials.
- Use ISO/IEC 14021, Environmental Labels and Declaration, Self-Declared Environmental Claims (Type II environmental labeling) to identify the recycled content of infrastructure used onsite.



Infrastructure II-2

Mid-Term

- Strive to achieve the sum of postconsumer recycled content + on-site reused materials + one-half of the pre-consumer recycled content constitutes at least 75% of the total mass of infrastructure materials.
- Pursue Institute for Sustainable Infrastructure “Envision” verification where feasible.

Long-Term

- Strive to achieve the sum of the postconsumer recycled content + on-site reused materials + one-half of the pre-consumer recycled content constitutes at least 90% of the total mass of infrastructure materials.

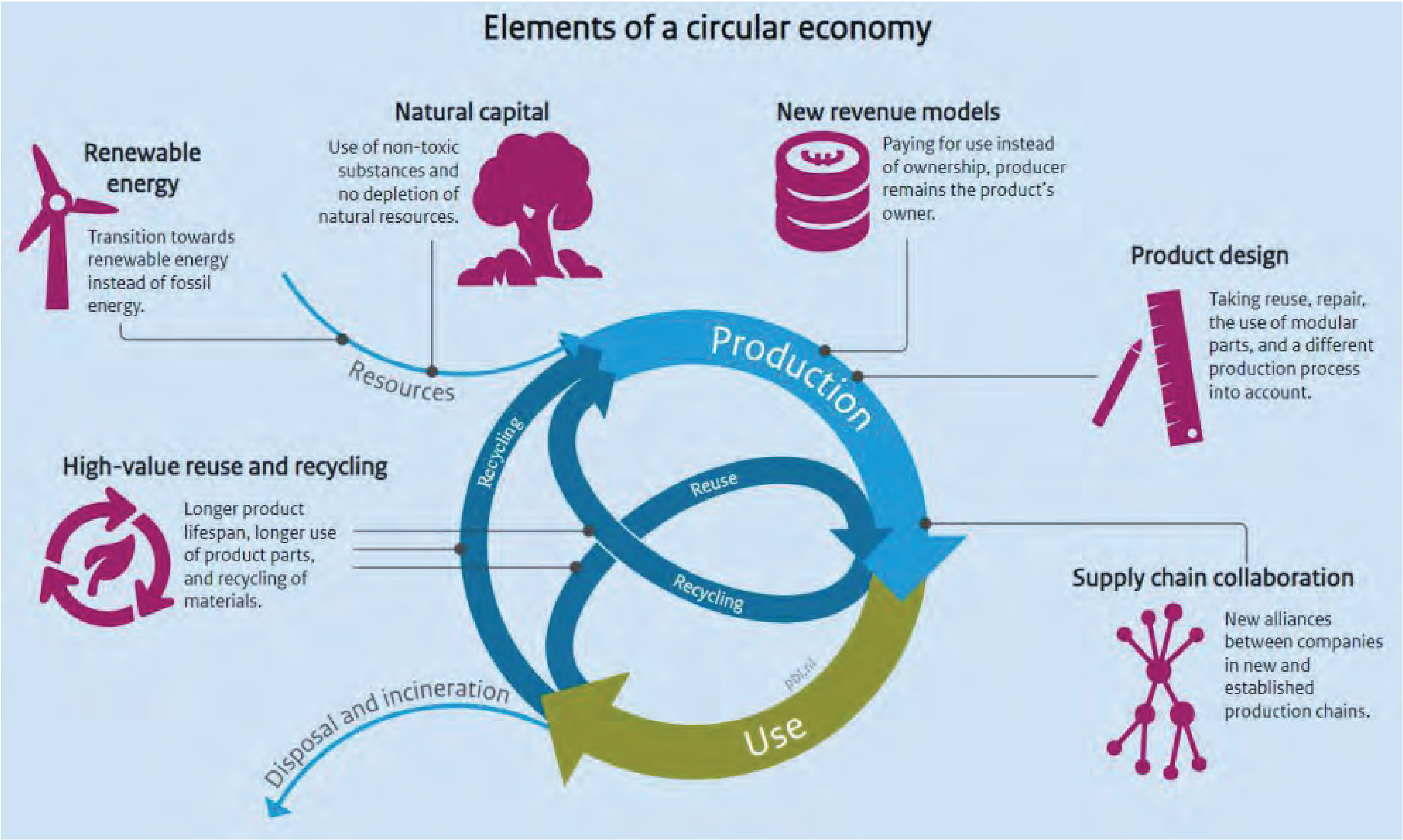
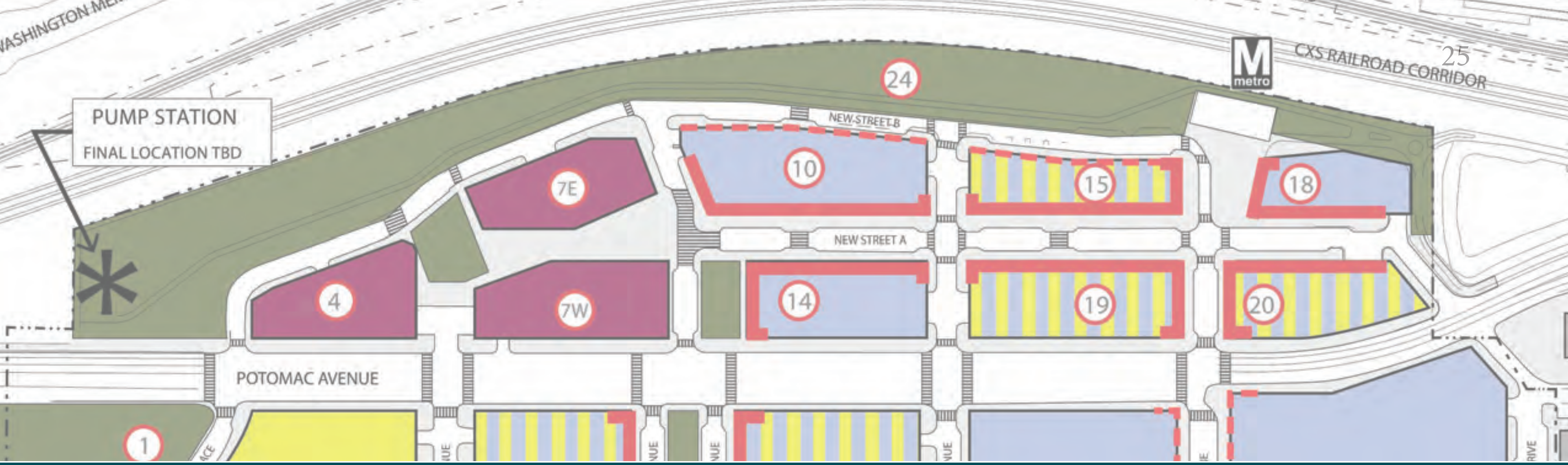


Figure 27. Waste reduction, diversion, and recycling/reuse are key components of a circular, sustainable economy.



Ongoing Operations II-3

DEFINITION

Upon redevelopment, there are a variety of different types of waste that North Potomac Yard will address operationally on an ongoing basis including:

- Recyclable Materials – Metal, Glass, Paper, Cardboard, and Plastic Bottles/Containers[11]
- Compostable Waste – Fruit scraps, vegetable scraps, bread, pasta, rice, grains, cereal, nuts, beans, seeds, coffee grounds, filters, tea bags, egg shells, flowers.
- Non-Compostable Waste – Meat, fish, shellfish, dairy products (cheese, butter, ice cream, etc.), fats oils, grease, pet waste, foam, plastic bags/wrap/film, yard waste, rubber bands, small fruit labels, diapers[12]
- Bulk Waste – Furniture (desks, chairs, couches, tables, etc.) and Electronics (TVs, computers, printers/scanners, hard drives, phones, CDs, DVDs, etc.)
- Wet Waste – Paper towels from public or private facilities. Certain wet waste products can be composted
- Non-Recyclable Waste – Material that is not capable of being recycled or reused (i.e. must be disposed of in a landfill)[13]
- Hazardous Waste – Batteries and Mercury Containing Light Bulbs

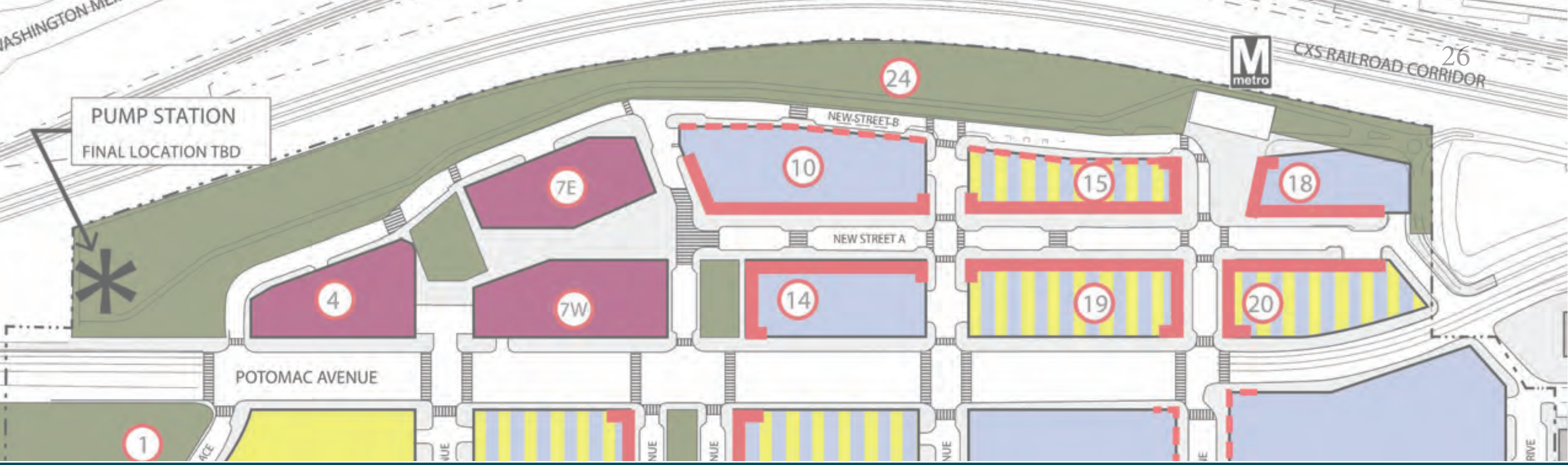
Figure 28. Composting collection

Figure 29. Recycling of paper, cardboard, metals, plastics, and glass will help meet solid waste reduction goals.

GOALS

1. Implement innovative waste management strategies where feasible.
2. Encourage behavior change by educating occupants, tenants, and visitors on best practices for effective waste management.
3. Make waste diversion a priority through a series of flexible, ongoing strategies to confirm performance.

11. "Recycling 101," Waste Management
12. "Compost Resource Recovery Stations," City of Alexandria
13. "Recycling 101," Waste Management



Ongoing Operations II-3

TOOLKIT

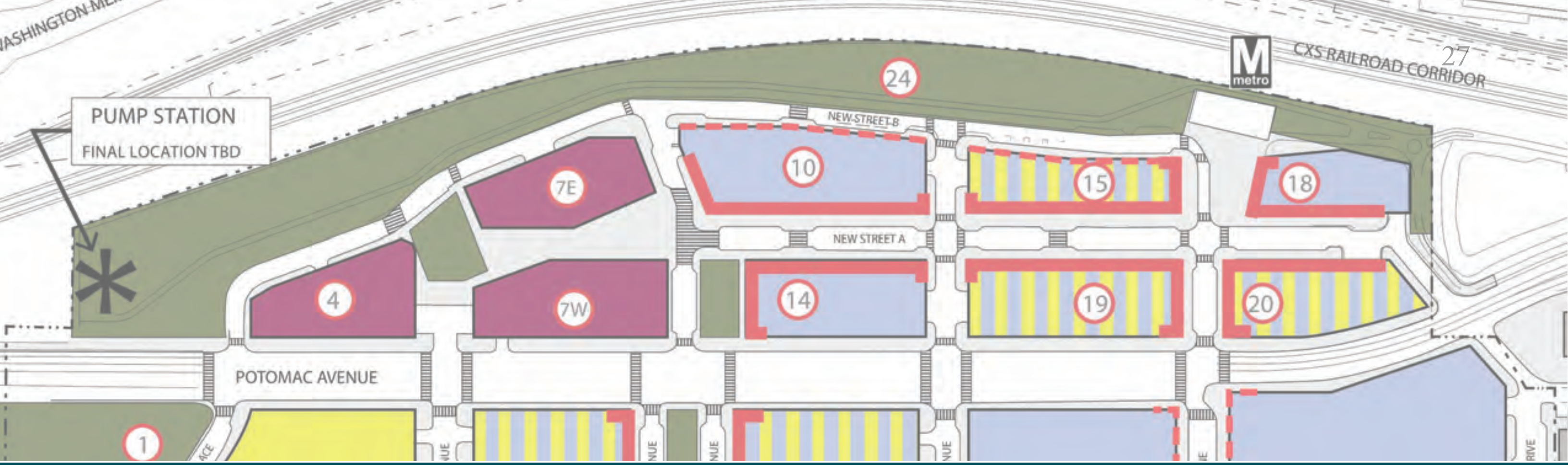
Short-Term

- Provide larger recycling containers in comparison to the size of trash containers.
- Provide ample opportunities for recycling bins throughout public space both indoors and outdoors as well as sufficient storage for peak demand.
- Incorporate network connected trash and recycling bins with solar compactors (reduces collection frequency).
- Install special glass-only recycling containers throughout the public space both indoors and outdoors.
- Install recycling signage/imagery to clearly outline proper recycling practices and help with quick decision making.
- Provide training for all FTE in residential or commercial spaces on sustainable purchasing habits and proper waste disposal.
- Optimize the location of waste collection areas or bins to ensure better access for both users and the waste collection agency.
- Provide three (3) reusable bags to each new resident that moves in the residential buildings.
- Require landscapers to properly dispose of organic yard waste that is created through routine landscaping operations.
- Incorporate waste tracking (Arc Platform, Energy Star, EnergyWatch, etc.) to analyze ongoing waste operations and determine if waste generation is being reduced and diversion rates are high.
- Complete annual waste audits of the properties within the NPY area to determine recycling rates and areas for improvements.
- Sustainable Purchasing: Encourage the purchasing of materials or products that can either be recycled or composted.

Mid-Term

- Conduct bi-annual educational campaigns to provide information on the importance of proper waste disposal.

Figure 30. Clear signage helps occupants recycle and compost more effectively



Ongoing Operations II-3

Mid-Term cont.

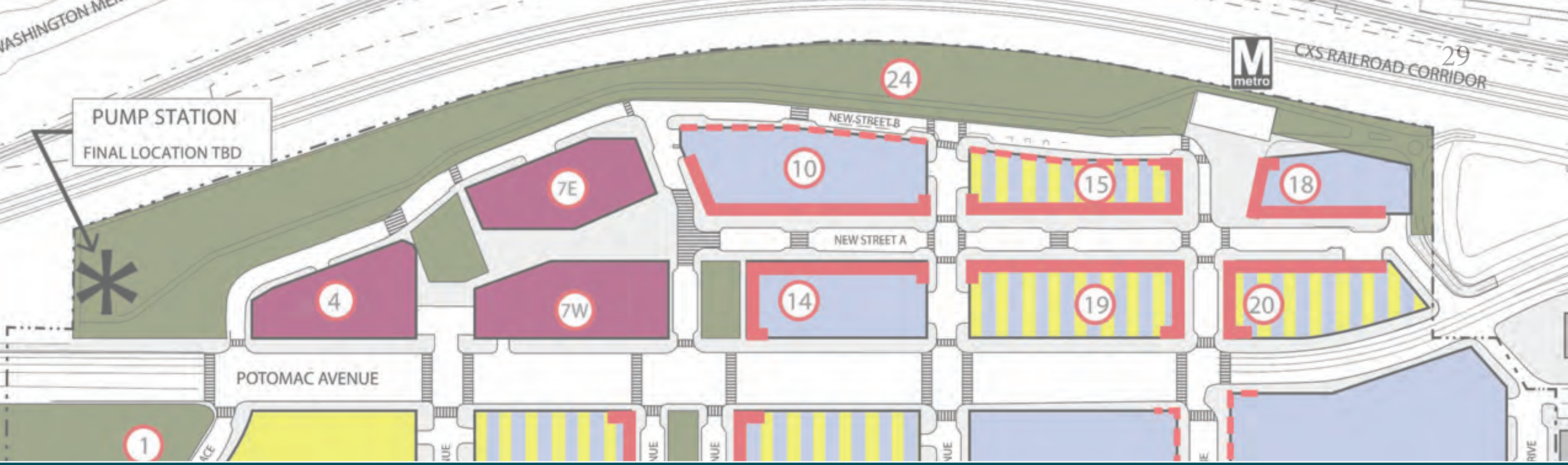
- Conduct bi-annual educational campaigns to provide information on the importance of proper waste disposal.
- Develop a website with resources for visitor and occupant use. Include information on what can be recycled or composted, and how to recycle and compost. Provide directions to donation sites, recycling centers and composting locations, and resources such as downloadable signs, media kits or sample letters to tenants. Establish a forum for furniture re-use/recycling and donations within the complex.
- Expand glass recycling to include a glass recycling collection container within the NPY area. Or provide a glass recycling container within each building or phase of NPY.
- Implement a drop off and storage area for potentially hazardous office or household wastes such as batteries, light bulbs, oil, and more.
- Encourage the use of commercial compactor rooms within buildings to reduce the frequency of trash collection/pick up.

Long-Term

- Coordinate with nearby schools or academic institutions to develop educational outreach and programs.
- Require waste hauler vendors to have corporate sustainability report or program in place.
- Incorporate infrastructure to support food recovery efforts with local food banks and restaurants (note that policy/code will have to change)
- Coordinate with local farmers markets or composting organizations to develop a collection or drop off point within NPY.
- Share waste tracking data with occupants to inform research and development of new

Figure 31. Providing commingled and glass recycling options will help NPY achieve solid waste reduction goals.

WATER



Water III

BACKGROUND

This section focuses on the importance of water conservation on a building and neighborhood-level. Reducing water usage- to include both potable water and graywater- through more efficient equipment and fixtures, capture, and recycling is critical to ensuring that the water balance of the site, neighborhood, and watershed is maintained. Actions taken to reduce water demand at the micro-local level (residential units, retail and office fit-outs, etc.) can result in scaled impact at the community level. What is done on a neighborhood level impacts the larger community and the world; using less water means there is more available for everyone.

Reducing water usage also reduces the amount of energy needed to process it, which in turn reduces carbon dioxide and the need for fossil fuels. It also aids in the conservation of local water bodies, which we rely on for drinking water and recreation. Potable water is a shared resource on which everyone relies. While currently underpriced, as the climate changes, weather patterns become more extreme, and water becomes scarcer, this could change. Designing “water-smart” buildings and landscapes now is a means to build more resilient communities.

NPY will focus on an “efficiency first” approach, which means reducing the need and use of water where feasible. If the project can first reduce the demand for water, it can then supplement some of the remaining need with treated graywater where possible:

Reduce total water usage

↓

Reduce potable water usage

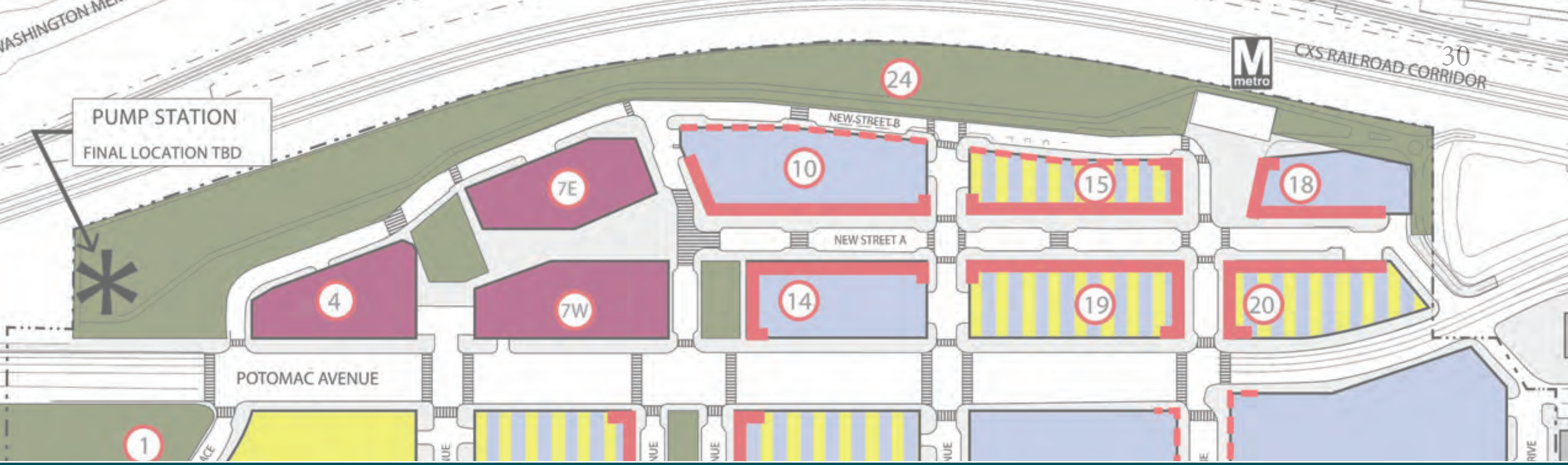
↓

Capture and recycle gray water

↓

Reclaim, treat, and reuse wastewater

A majority of the strategies listed in the Water toolkits are Short- or Mid-Term, as they can be implemented at building construction or within a few years of building delivery.



Potable Reduction III-1

DEFINITION

Potable water, also known as drinking water, refers to water that has been treated and is safe to drink, handle, use for food preparation, and bathe in. It is a finite resource, and only 0.007% of the world's water is available and potable[14]. The project's water sources include the Potomac River and Occoquan Reservoir.

GOALS

1. Employ effective water conservation to maximize the value of the resource.
2. Specify high-performance and quality fixtures that do not compromise experience.
3. Encourage tenants, occupants, and visitors to be mindful of excessive water usage.

Figure 32. Irrigation rain sensor

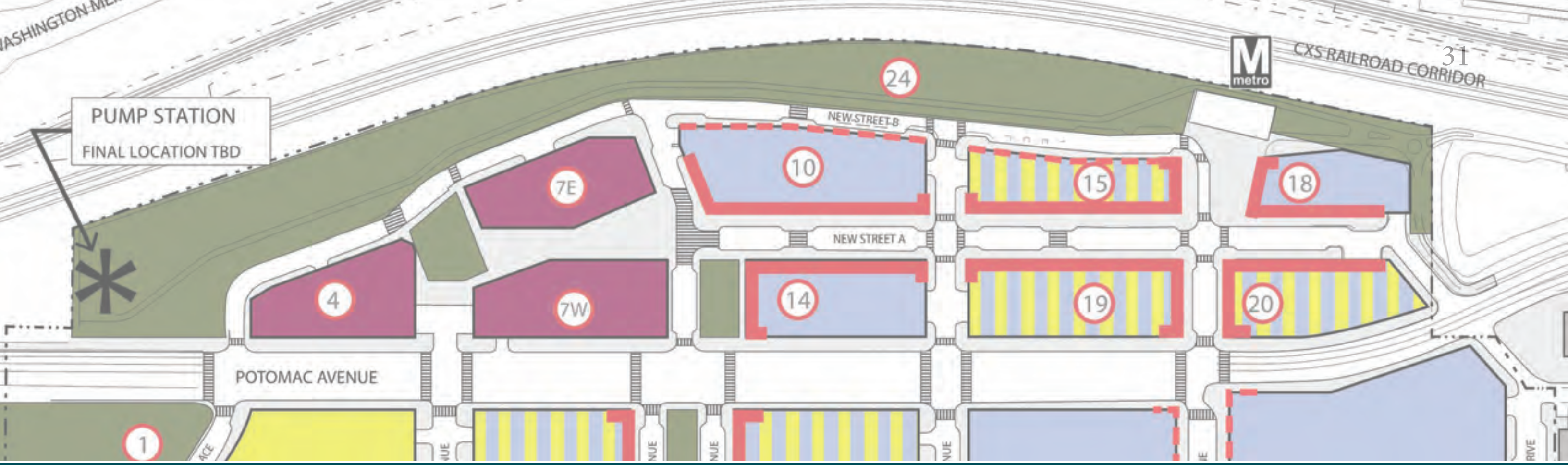
Figure 33. Low-flow water fxxture

TOOLKIT

Short-Term

- Install WaterSense-labeled water fixtures, such as toilets, urinals, lavatory faucets, showerheads, and kitchen faucets.
- Install low-flow water fixtures; possible flow rates include 1.28 gpf or dual-flush toilets, 0.125 gpf urinals, 0.8 – 1.5 gpm lavatory faucets, 1.5 – 2.25 gpm showerheads, 1.0 – 2.0 kitchen faucets, 1.4 gpm pre-rinse spray valves. Flow rates will vary depending on building and occupant type.
- Design the landscape such that the species chosen, plant spacing, soil conditions, and overall density results in a minimum 50% reduction in water required from the calculated baseline for the site's peak watering month.
- Avoid providing irrigation beyond the establishment period: where drought-tolerant plants can be used, install only temporary irrigation to ensure their viability will be provided for 2 years.
- Implement sustainable irrigation controls such as installing smart scheduling technologies and weather and soil moisture sensors.

14. "Freshwater Crisis," National Geographic



Potable Reduction III-1

Short-Term cont.

- Meter overall building and site water use and share data with a third-party.
- Install submetering infrastructure on major water end uses.
- Ensure ongoing maintenance of landscaped areas to remove weeds, add mulch, balance soil nutrients and structure, and remove dead branches in order to reduce unnecessary water demand.
- Commission and regularly audit site irrigation systems to identify inefficiencies, fix leaks, adjust sensors, and relocate or remove sprinklers if watering needs have changed.

Mid-Term

- Install building-wide leak detection systems with sensors (wicking, moisture, contact, acoustical water flow), alarms, and automatic shutoff to identify leaks and inefficiencies.
- Test water quality at key locations in buildings and provide results to occupants.
- Implement a legionella management plan that includes processes for corrective action.

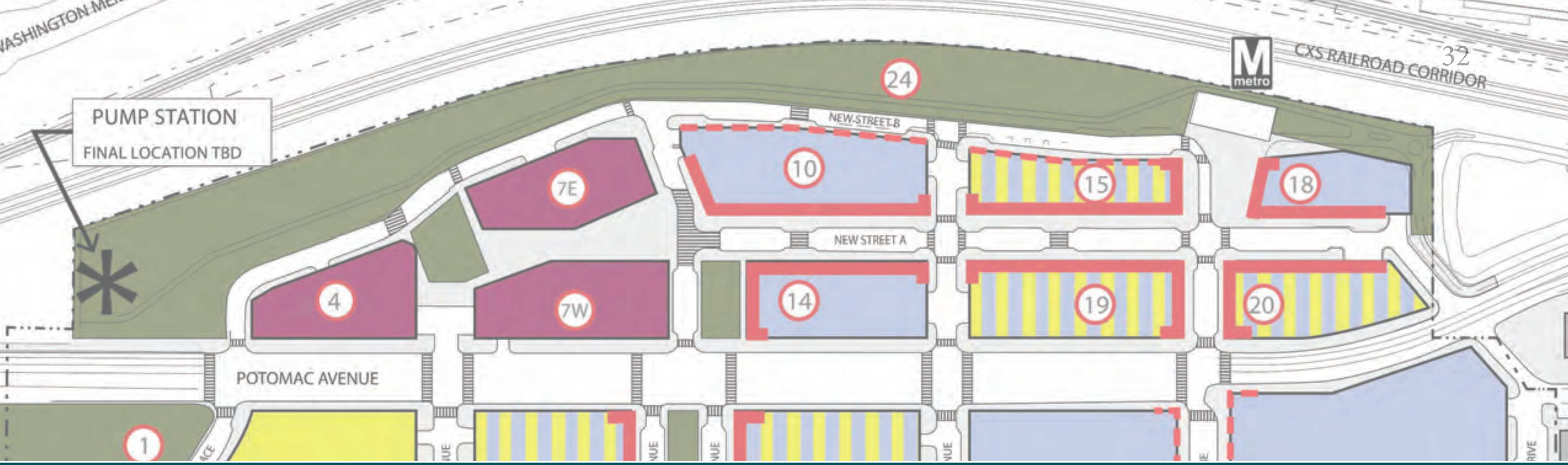
Long-Term

- As technologies evolve, replace water fixtures with more efficient models.
- Develop an action plan to future-proof NPY in the event that extreme weather events negatively affect the community's potable water supply.
- Share water use data with project occupants, institutions, and even the public to inform research and development of new technologies.
- Participate in an ongoing certificate purchasing program to offset potable water use and support offsite, receiving waterbody restoration.
- Ensure filtration or treatment is in place so as to not exceed sediment, microorganism, dissolved metal, organic pollutant, disinfectant, pesticide, fertilizer, and public additive thresholds.

Figures 34, 35. Submeters alert building operators to possible leaks in order to prevent unnecessary water use.

Figure 36. Filtration ensures a high level of water quality

SHORT-TERM MID-TERM LONG-TERM



Reuse Opportunities III-2

DEFINITION

Water reuse enables buildings and sites to reduce the amount of potable water consumed by collecting, treating, and recycling water in a closed system. Recycled water can include water collected onsite or offsite, whether municipally supplied or generated by the project. Examples of alternative water sources include air conditioner condensate, rainwater, foundation drain water, industrial process water, and fire pump test water.

Figure 37. Tree well bioretention basins

GOALS

1. Explore opportunities for water reuse onsite.
2. Reduce pollutant load to storm and sanitary sewers.
3. Utilize stormwater and greywater as resources rather than waste products.

TOOLKIT

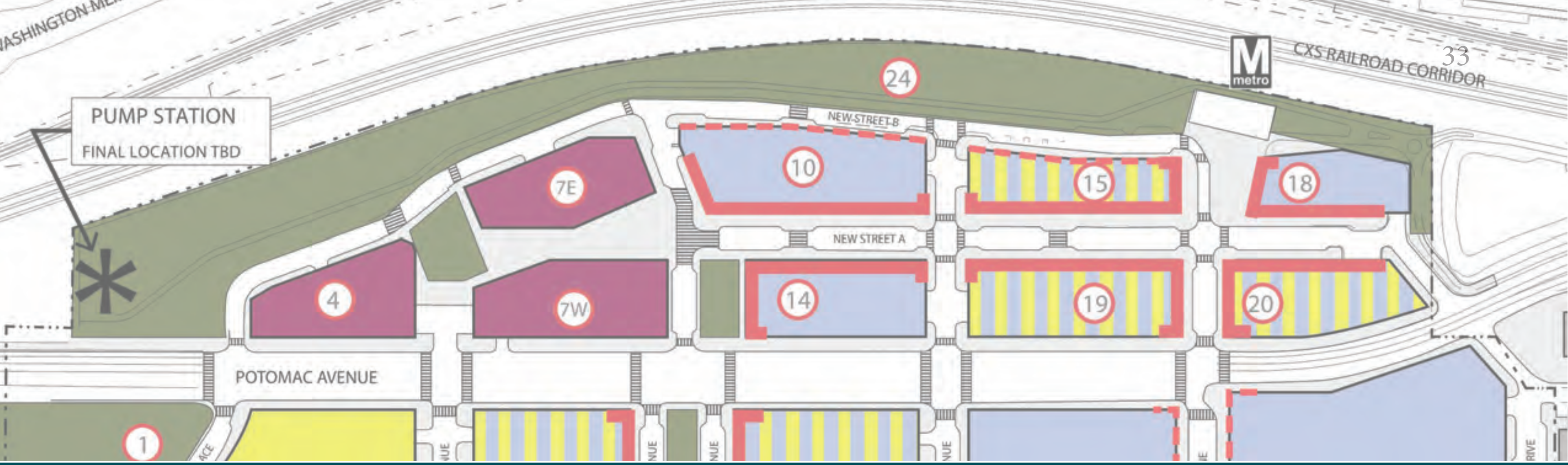
Short-Term

- Tap into a cistern to supply reused rainwater to streetscape, tree pits, parks, and open spaces, if and where needed.
- Collect and pipe rainwater to reuse in cooling towers after filtration.
- Capture and reroute condensate water for use in irrigation or back into the cooling tower as makeup water.
- Provide infrastructure for connections to a future Sanitary Wastewater Energy Exchange (SWEE) system.

Mid-Term

- Install a SWEE system to extract thermal energy from wastewater as an energy source for buildings. As the wastewater capacity increases, more energy is generated.
- Reuse greywater for uses where contact is not likely to occur (i.e. toilets and urinals).
- Implement a non-potable water safety plan to inspect all alternative water infrastructure for potential contaminants and exposure risk. Monitor odor control and operational parameters. List corrective actions.

SHORT-TERM MID-TERM

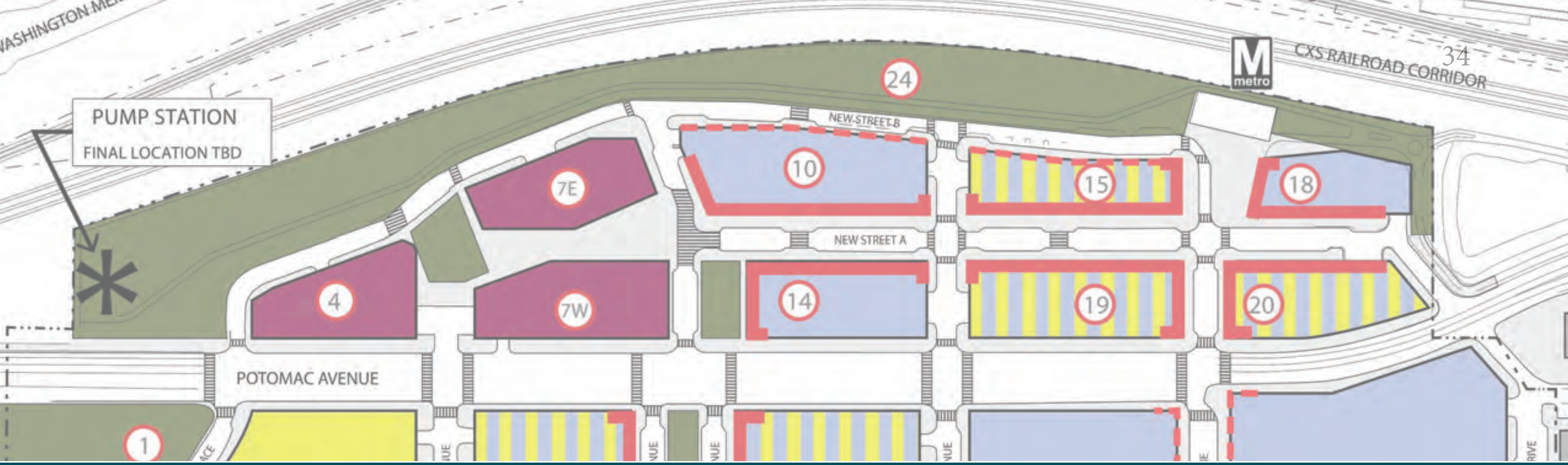


Reuse Opportunities III-2

Long-Term

- Realize the full impact of the SWEE system through an increase in wastewater volume when future phases of development come online.
- Install systems that recover nutrients (i.e. nitrogen, phosphorus, carbon loading) from used water and convert them into alternative ecological or agricultural applications.
- Minimize the generation of wastewater, or treat and reuse blackwater onsite.

Figure 38. SWEE infrastructure



Process Water III-3

DEFINITION

Process water includes all water uses that cannot be used for drinking or human consumption. Cooling systems, irrigation, cleaning, and appliances use a large amount of water. Process water can account for up to 50% of a residential building's total annual water use and almost 90% of an office building's use[15]. Of the process water used in commercial buildings, cooling systems make up 34% and appliances account for 14%[16].

GOALS

1. Prioritize the efficiency of major process water end-use
2. Balance process water efficiency with daily operational needs
3. Establish protocols to reduce water use in maintenance operations
4. Maintain equipment, appliances, and fixtures to optimize performance over time.

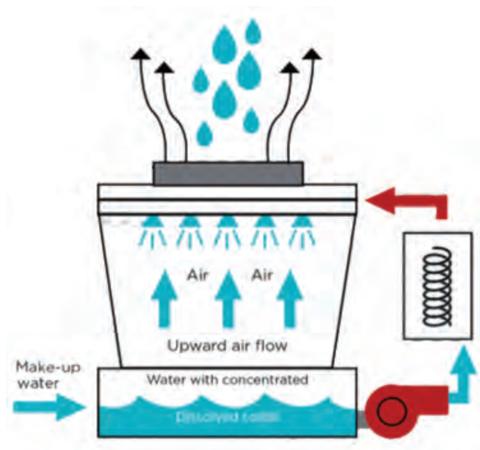


Figure 39. Cooling tower water use

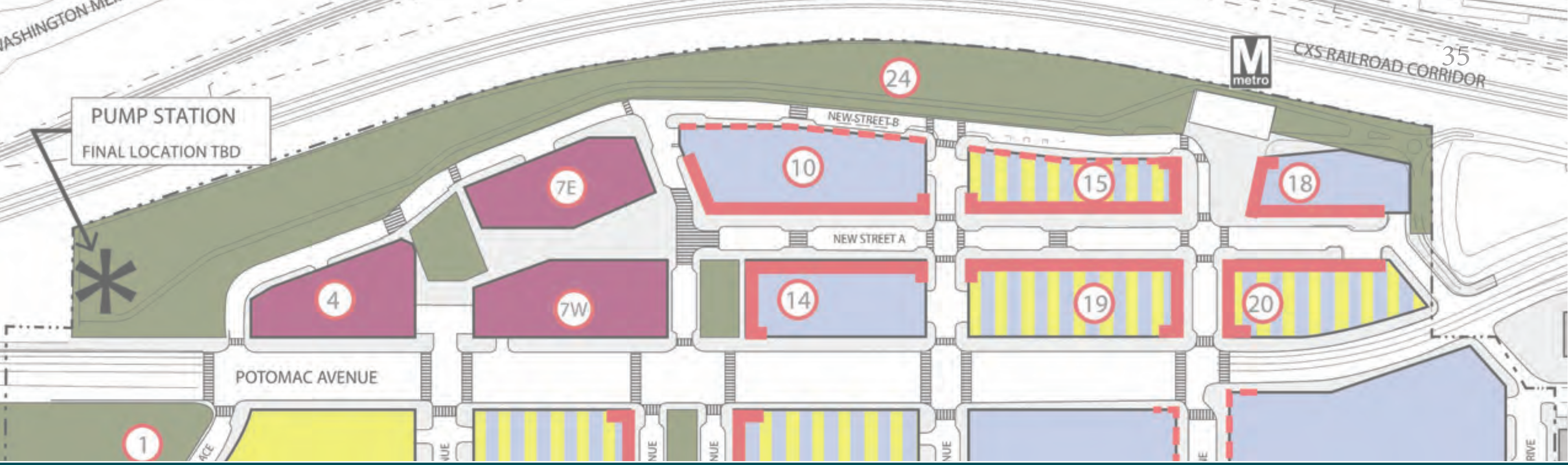
TOOLKIT

Short-Term

- Install ENERGY STAR appliances, such as clothes washers, dishwashers, ice machines, tankless water heaters.
- For heat rejection and cooling, prohibit once-through cooling with potable water for any equipment or appliances that reject heat.
- Create an operations manual that includes protocols for efficient indoor and outdoor water use in operations, to be implemented at building delivery.
- Equip cooling towers and evaporative condensers with makeup water meters, conductivity controllers, overflow alarms, and efficient drift eliminators.

Figure 40. ENERGY STAR appliances save energy and water

15. "Increasing Efficiency of Building Systems," US Department of Energy; "WaterSense at Work," US EPA
16. "Water Efficiency for Commercial Buildings," Massachusetts Water Resources Authority



Process Water III-3

Mid-Term

- Revise the operations manual according to evolving technologies and best practices.
- Implement detailed submetering of process water from janitor closets, pool rooms, water-using appliances, irrigation, boilers, domestic hot water, humidification systems, etc.

Long-Term

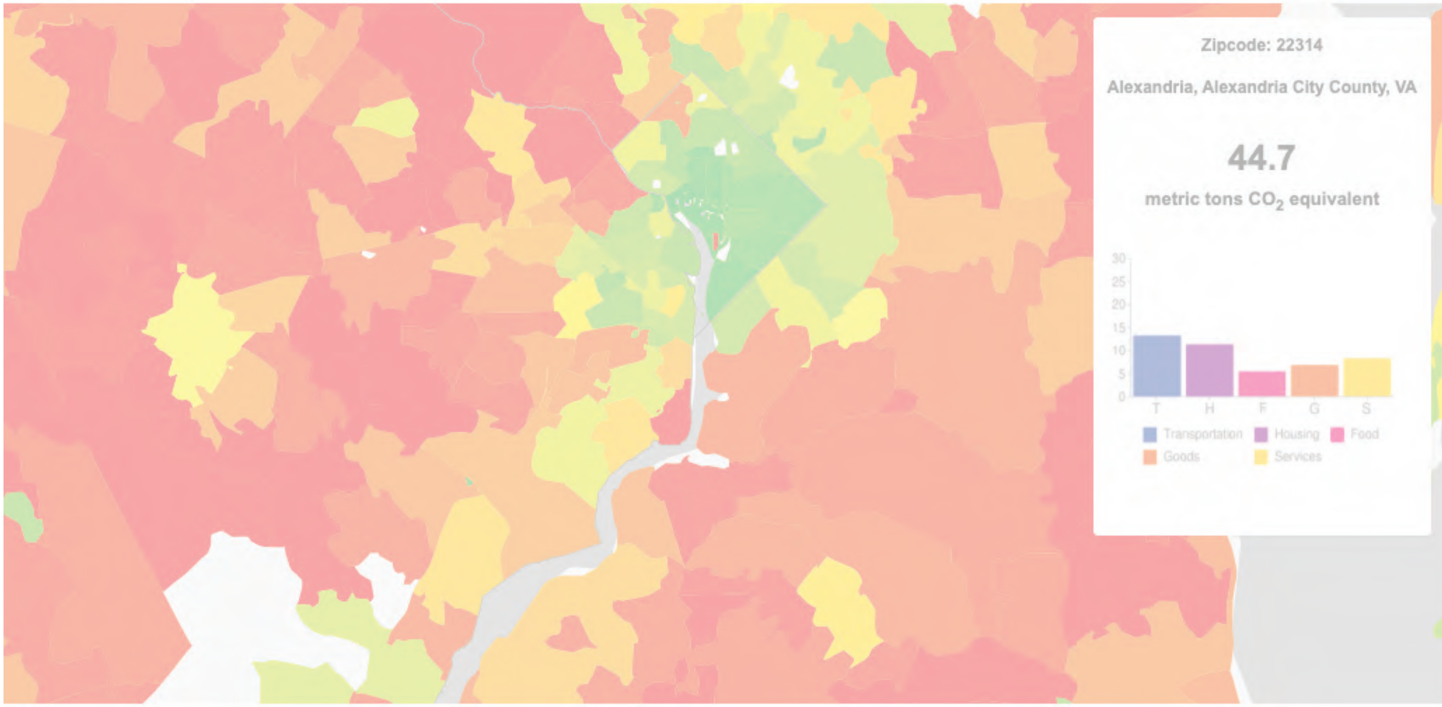
- Conduct a water audit that includes an analysis of water consumption, fixtures, and seasonal changes to identify use trends and opportunities for renovations or retrofits.
- Ongoing performance verification: use meters and data tracking to ensure current water usage still meets or exceeds original Long-Term targets.

Figure 41. Process water, including water used for cleaning and maintenance, presents and opportunity for water savings.

Figure 42. Stormwater can be collected and reused for irrigation

Figure 43. Building water use can be tracked in an ongoing manner.

CARBON


Zipcode: 22314
Alexandria, Alexandria City County, VA
44.7
metric tons CO_2 equivalent
30
25
20
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T
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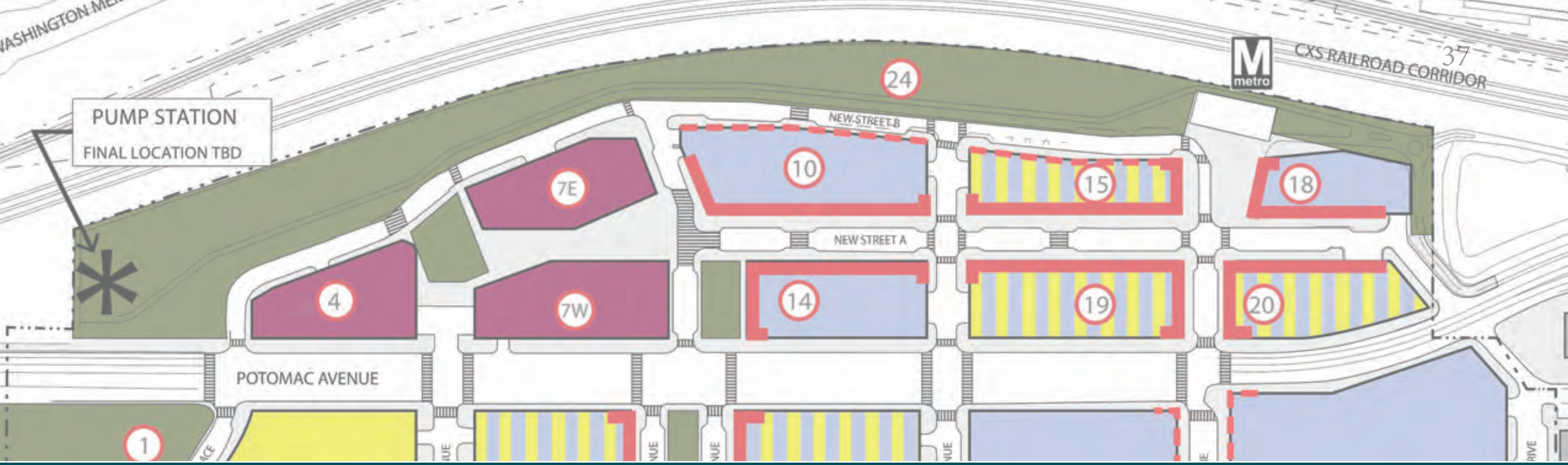
Transportation
Housing
Food
Goods
Services



Carbon IV

BACKGROUND

Embodied Carbon

Building construction and operations account for 39% of global greenhouse gas emissions, making it an important target for reducing overall CO2 emissions. A lot of direct attention has been put on reducing operational carbon produced by building energy consumption[17]. However, 11% of global CO2 emissions is produced in the form of embodied carbon from the extraction, manufacture, transport, and construction of building materials[18]. Unlike operational carbon emissions, which can be reduced over time with building energy efficiency renovations, embodied carbon emissions are locked in once critical decisions around structure and material choices are made and the building is built.

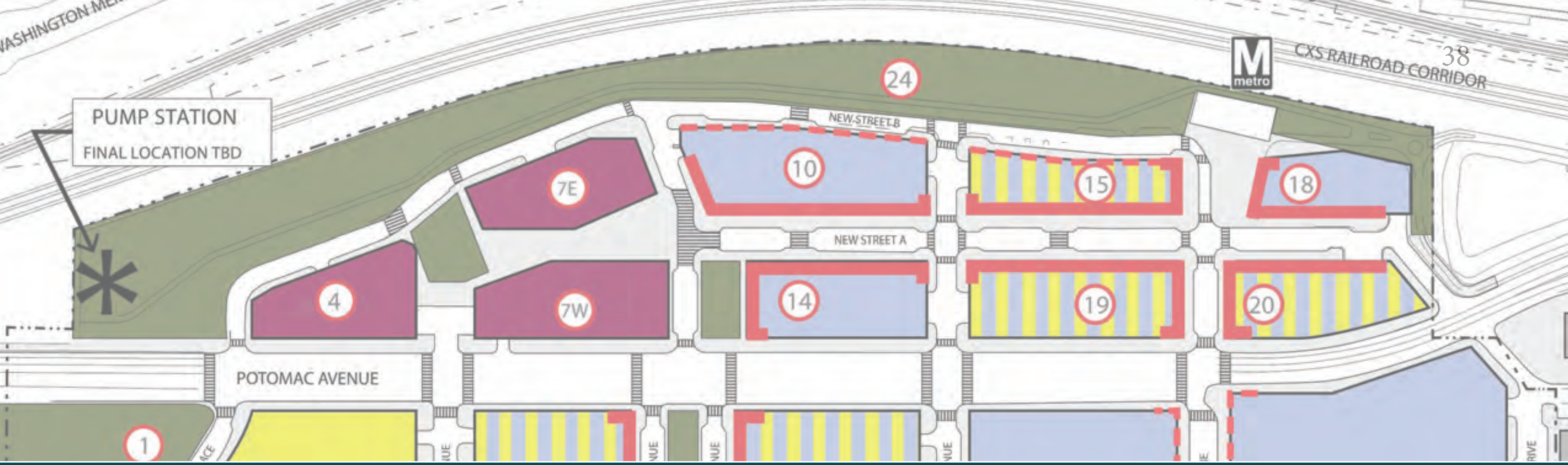
According to Architecture 2030, "new research from the IPCC, the UN, and the scientific community stresses the critical importance of a near-term milestone: if we do not achieve a 45-55% reduction in total global emissions over the next 10-20 years, we will have lost the opportunity to meet the 1.5/2 degrees Celsius warming threshold and climate change will become irreversible."[19] Over the past couple decades, we've made significant strides in reducing carbon emissions associated with operating buildings, and will continue to do so. In addition to operational carbon, an immediate focus on embodied carbon is essential to addressing climate change and meeting Paris Climate Agreement targets.

This section focuses on embodied carbon reduction strategies both at the building and neighborhood-level for North Potomac Yard. Embodied carbon is concentrated in the structure and enclosure of buildings, as well as materials used for infrastructure in site development. The most effective way to reduce overall district embodied carbon is to consider a variety of strategies early in design. NPY will focus on the following strategies to reduce embodied carbon throughout the site:

Build Efficiently
↓
Build Low Carbon
↓
Build for the Future

Operational Energy

Building energy efficiency is imperative in order to reduce the carbon footprint of the NPY district. The collection of strategies focuses less on prescriptive solutions for equipment selection and operation and instead defines a process of strategic considerations, critical review and performance guidelines that will guide the overall NPY development project towards long-term and sustained energy reductions.



Carbon IV

BACKGROUND (cont'd)

Renewables

Incorporation of renewable energy sources into NPY will be key to meeting aggressive carbon reduction goals. Fossil fuels – coal, oil, and natural gas – have high carbon compositions and when burned to create energy, release significant carbon into the atmosphere, contributing to the growing climate problems on the both local and global scales. On and off-site renewable energy generation looks to broaden the blend of and demand for fossil-fuel based energy sources to support the built environment. The technologies and economics for renewable energy is rapidly changing and it is important to build in, where possible, flexibility to take advantage of this evolution. Introduction of focused renewable energy solutions will help put NPY on a path to meet carbon-neutral goals over the coming decades.

In 2019, Virginia set a target of 100% carbon-free power by 2050. VA ranks high in future market opportunities for renewables, as it recently signed a record 420 MW solar and wind power contract for state government agencies[20]. The broader solar market in the state and nation continues to grow. Whether by generating electricity with on-site renewable energy sources or by investing in Renewable Energy Certificates, progress towards carbon reduction goals can be made using the strategies outlined on following pages.

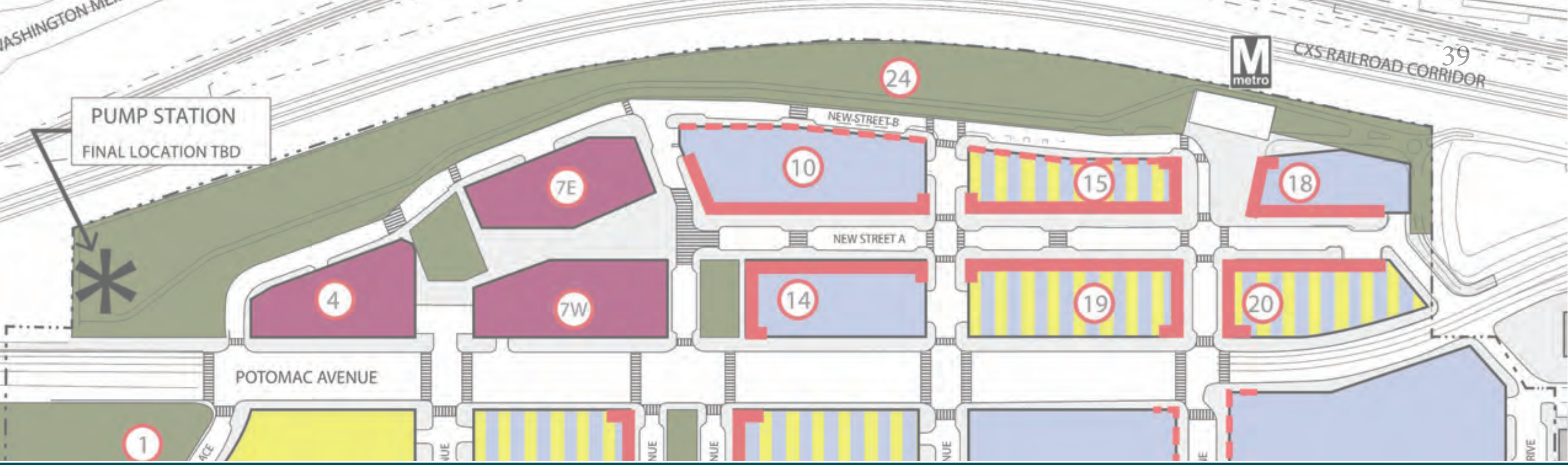
Transportation

The contribution of transportation to carbon emissions is significant, but carbon-neutrality goals can be realized through a coordinated, cohesive, district-wide approach. Sustainable transportation in NPY includes:

- designing transportation systems to be more energy efficient,
- organizing on-site transportation infrastructure to prioritize efficiency,
- setting the project up for future shifts towards electrification, and
- changing behavior to reduce traffic and manage demand.

Petroleum-reliant transportation, while ubiquitous in society, is harmful to the environment: burning one gallon of gasoline creates about 20 pounds of CO_2[21], which adds up significantly when considering how many vehicles are on the road today. Modes of transportation (such as fully electric and hybrid vehicles and bicycles) powered by energy produced without fossil fuels emit significantly less (or zero) greenhouse gases. NPY will encourage a shift towards alternative transportation options, such as Metrorail, buses, bicycles, walking, and carpooling, resulting in a reduction of carbon emissions.

20. "Governor Ralph Northam Signs Executive Order to Expand Access to Renewable Energy, Support Clean Energy Jobs of the Future"
21. "Gasoline explained: Gasoline and the environment," US Energy Information Administration



Embodied Carbon IV-1

DEFINITION

Build efficiently: one of the most effective ways to reduce environmental impact, and in this case embodied carbon, is to reduce the use of new, carbon-intensive materials. Although as a society we will always keep building to accommodate existing and new community needs, it is important to consider opportunities to design efficiently and reduce the demand for new materials wherever possible. Focused attention on the building life cycle will result in a neighborhood that has a lower carbon footprint.

Build low-carbon: after finding opportunities to reduce the amount of material in the design, specifying low carbon materials is the best way to reduce embodied carbon. From specifying a high recycled content to choosing an alternative material that requires less processing, there are many strategies to specifying materials with reduced environmental impact.

Build for the future: once strategies for reducing material and specifying lower impact material have been incorporated, considering how the buildings and site can be adapted for the future will ensure that the development continues to reduce its embodied carbon. Making spaces more adaptable and building components easily replaceable reduces the need for building new in the future, and therefore reducing overall embodied carbon.

NPY is committed to building efficiently to reduce embodied carbon, while ensuring that development performs effectively. Where feasible and market-viable, the project will design and specify materials to reduce overall embodied carbon. Balancing current functionality with future unknown needs will be an important component of achieving an adaptable neighborhood that can change with time.

Figure 44. Building and material components included in an LCA

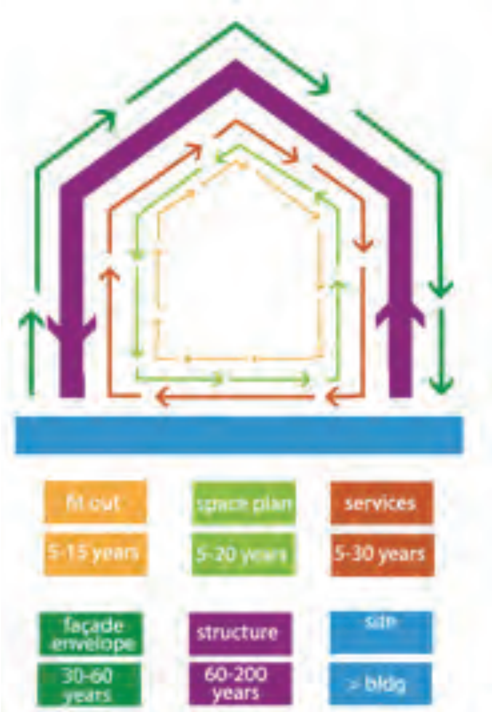
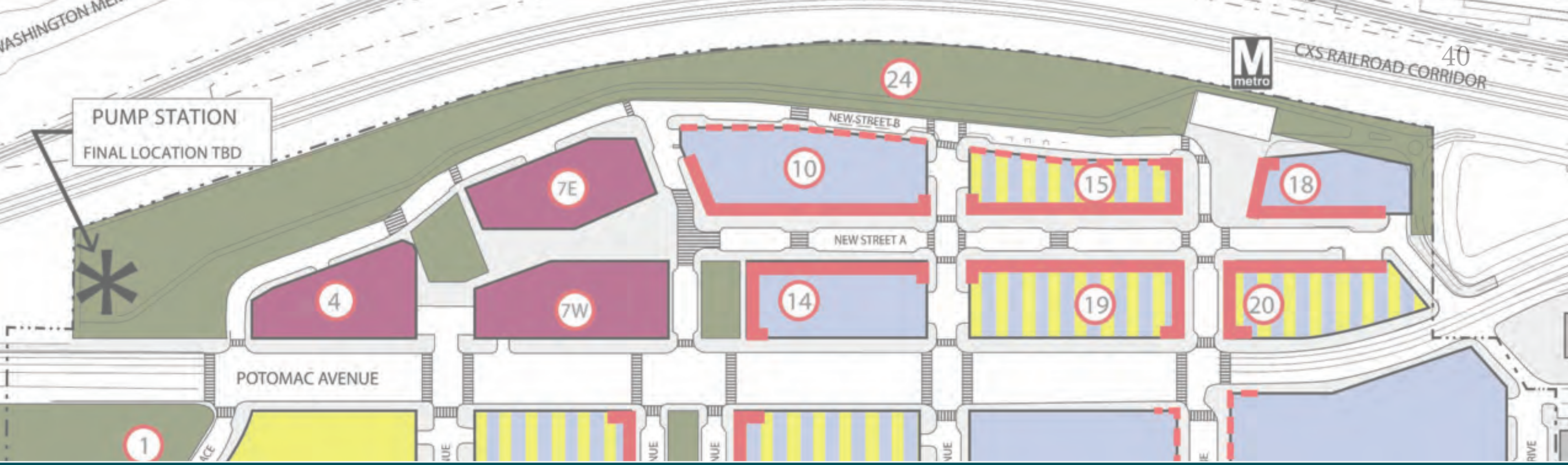


Figure 45. Average life cycle of building and site components



Embodied Carbon IV-1

GOALS

1. Design and construct buildings to maximize material efficiency.
2. Promote district-wide solutions that focus on low-carbon, efficient materials.
3. Embrace innovative low-carbon technologies and adaptable space design.
4. Establish maintenance and deconstruction guidelines for equipment, finishes, and façades to optimize life cycle.

Figure 46. Voided slab construction

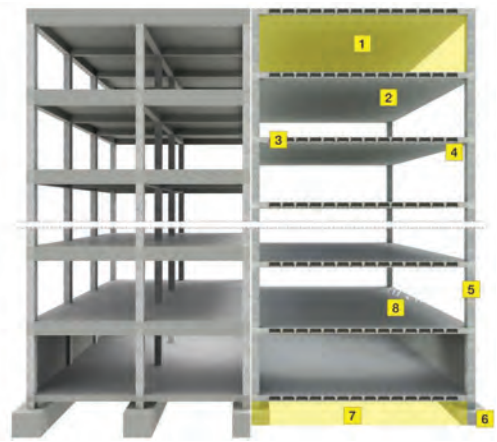
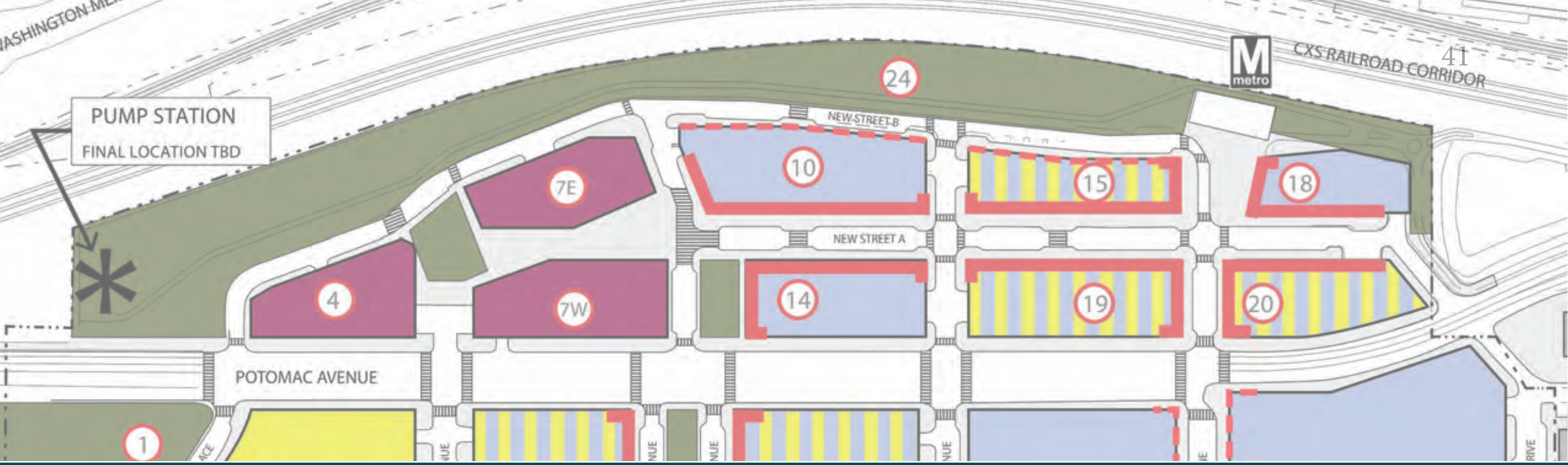


Figure 47. Voided slab construction-cross section

TOOLKIT

Short-Term

- Select products that are bio-based, rapidly renewable, recycled, and/or reused. Do not use tropical wood products. Exclusively purchase FSC certified wood products.
- Source wood and timber products from manufacturers that are recognized by the Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), and Forest Stewardship Council (FSC). Source rock, metals, and minerals from a third-party standard for sustainable resource extraction, such as the National Stone Council (NSC) 373 for dimensional stone products.
- Consider renovation or material reuse, wherever feasible.
- Design using efficiency strategies that reduce the amount of waste generated during construction.
- Reduce overall weight of the superstructure, decreasing loads to the foundation.
- Seek to simplify the design when possible; simple designs typically require less material.
- Review material efficiency options like designing to standard building sizes or for a repeating module.
- Reduce the amount of reinforcement in the design.
- Consider spaces that can be shared or multi-functional, therefore reducing the need for more spaces.
- Work closely with the design team to ensure the structural system is the most appropriate for the façade system.
- Specify products with high recycled content.



Embodied Carbon IV-1

Short-Term cont.
- Use a high cement replacement mix (slag & fly ash) when feasible, managing the need for early strength gain through scheduling.
- Use recycled aggregate where possible.
- Use EC3 or other material carbon database to compare the embodied carbon of materials.
- Perform Life Cycle Assessment on buildings to meet carbon reduction targets.
- Use 100% recycled reinforcing steel.
- Design buildings and spaces which are sufficiently flexible to be adapted to meet future requirements, while also having a timeless or adaptable aesthetic.
- Support the transition from first to second user and allow for changes in use.
- Design to provide easy access for maintenance and facilitate replacement of shorter life span components.
- Incorporate larger floor to ceiling heights than required to allow change of use and for provision of future services.

Mid-Term
- Consider using concrete products like CarbonCure, which enables CO2 to be added to ready mix concrete. The CO2 is permanently sequestered into the concrete, while further minimizing the concrete's carbon impact be reducing its most carbon-intensive ingredient.
- As mass timber becomes readily available, consider designing wood structures.
- Consider the use of more natural and renewable materials.
- Mechanically fix systems rather than adhesive fix so they can be demounted and re-used or recycled, supporting a circular economy.
- Consider modular construction.
- Consider a voided slab design that may reduce overall weight of the building.

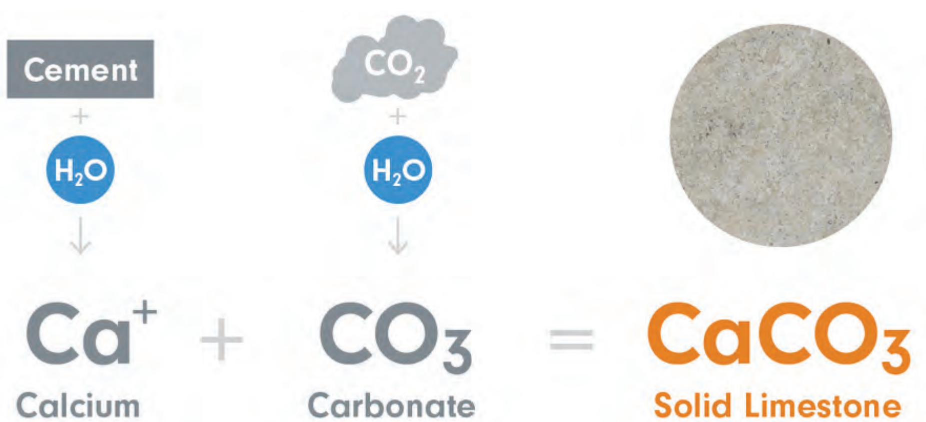
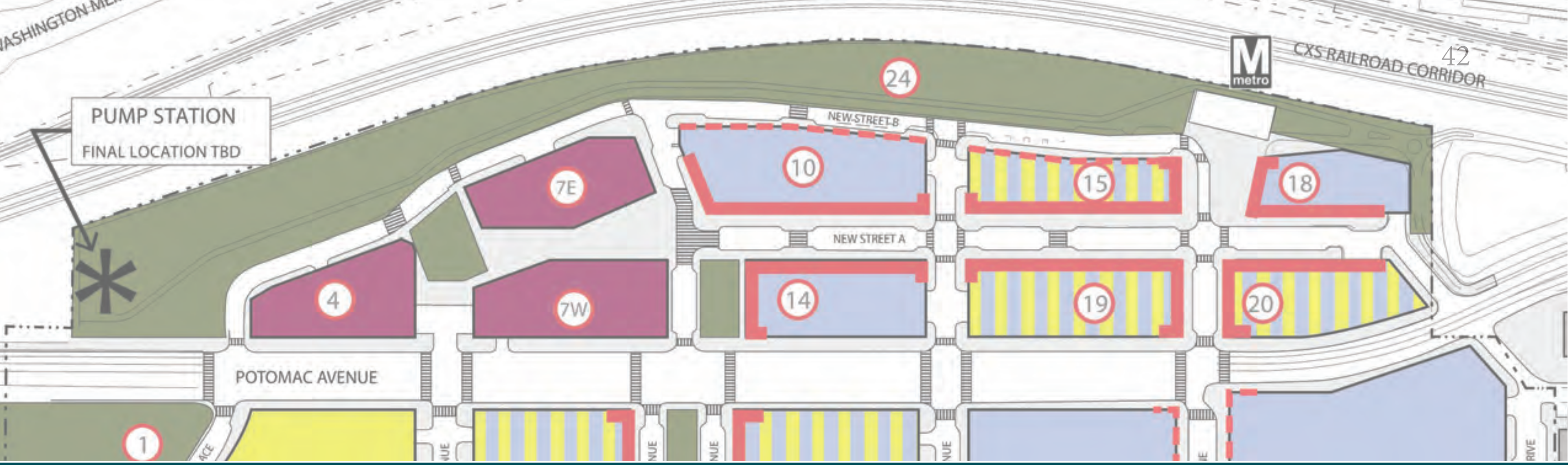


Figure 48. CarbonCure process



Embodied Carbon IV-1

Long-Term

- Consider off-site construction opportunities which occur in a more controlled environment that can reduce waste.
- As renewable energy technologies become more prevalent, purchase materials from manufacturers that use renewable energy resources for manufacturing goods.
- As more information emerges about concrete alternatives, consider materials such as Limecrete or Hempcrete where performance requirements allow, such as in ground floor slabs.
- Consider and research new and innovative materials with reduced embodied carbon.
- Explore methods of creating longevity without additional coatings, as they can reduce the recyclability of the material.
- Design for easier whole building deconstruction to reduce future material salvage time and effort.
- Design buildings in layers with their associated lifespans.
- Design for deconstruction to enable components to be disassembled and replaced.

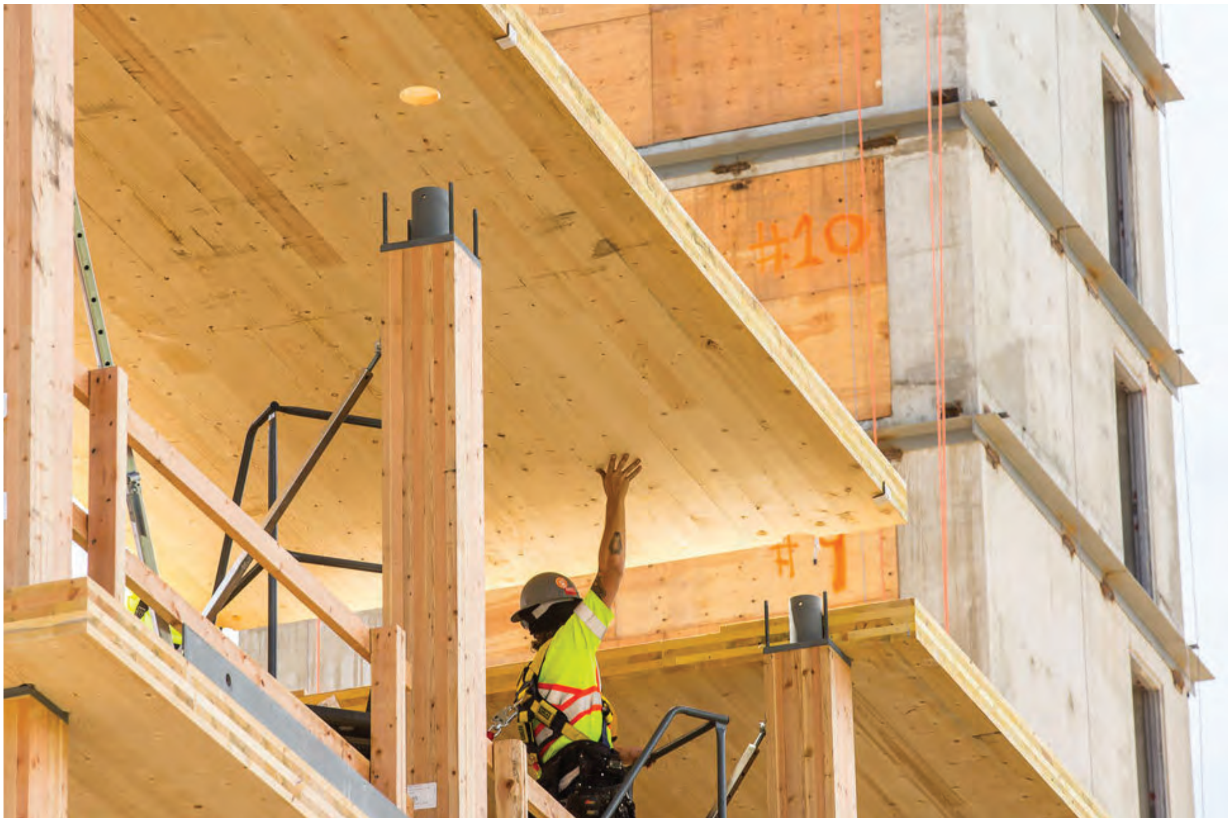
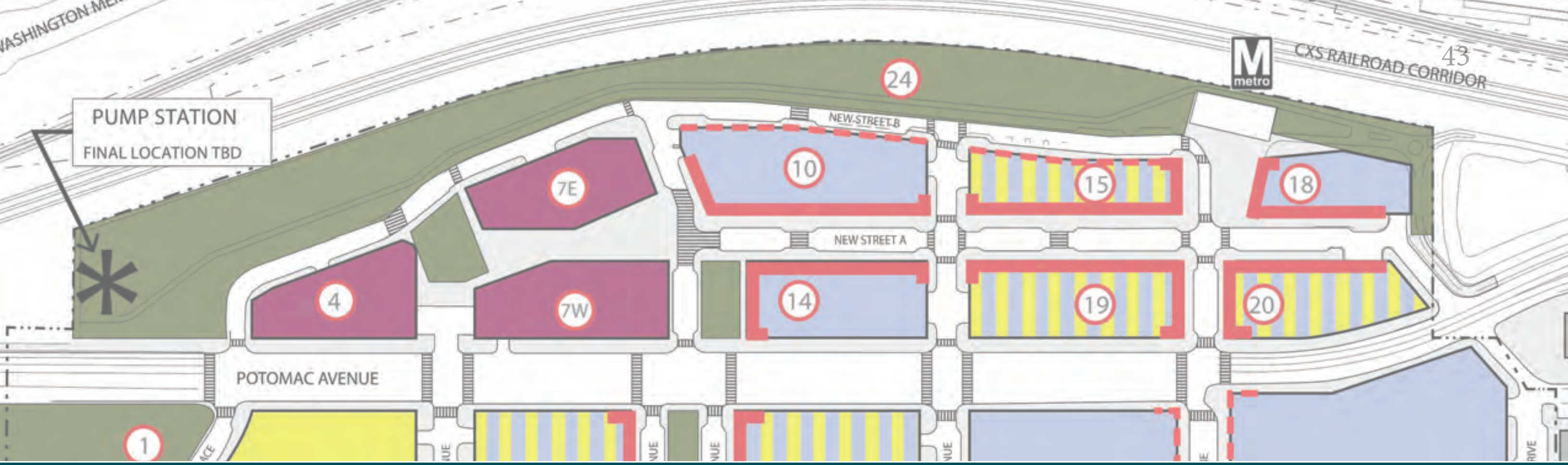


Figure 49. Mass timber construction has lower overall embodied carbon compared to typical construction



Operational Carbon IV-2

DEFINITION

Passive Design and Envelope Optimization: Building massing, envelope, and orientation not only affect heating and cooling loads, but also allow for effective daylighting and have a significant impact on occupant comfort. Envelope loads generally represent 20% to 50% of building peak heating and cooling loads and have a significant impact on operational energy. Effective insulation and solar design can reduce these peak loads by 25% to 75%, which reduces installed equipment sizes while also reducing operating costs. Many passive design and envelope improvements are one-time investments that require little or no ongoing maintenance or replacement during a typical 30-year building lifecycle.

Figure 50. Buildings account for 39% of global energy-related CO2 emissions annually

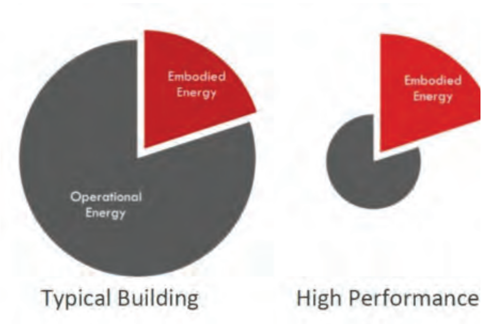
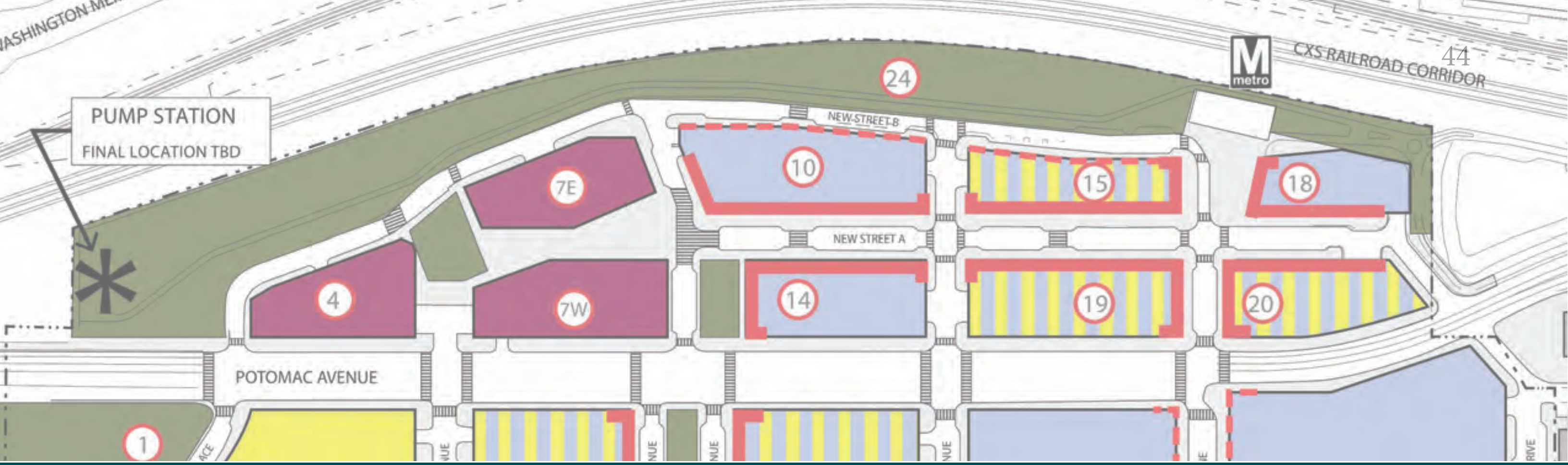


Figure 51. In a high-performance building, operational energy is a much smaller percentage of its overall energy profile.

Internal Loads Optimization: Internal energy loads such as lighting, appliances, elevators, computers, printers, and other plug load equipment are dynamic and generally account for 25 - 50% of the total annual building energy consumption. Although some of these loads may not be completely within in the owner's control, design strategies are available to minimize energy consumption from these end-uses.

Effective Ventilation Control and Design: Ventilation can account for 25%-50% of the total heating/cooling load for buildings and provides a compelling opportunity for reducing energy consumption over the life of a building. Most spaces are designed to be over-ventilated during most operating hours. For example, most residential spaces are ventilated 24/7 whether the space is occupied or not. Also, most outside air calculations focus on dilution of contaminants through ventilation and not the actual quality of the air.

Decarbonization-Ready Systems: As the power generation mix of the Virginia electric grid continues to move toward renewable energy and away from coal, natural gas, and oil, the optimal systems and fuels for a zero-carbon building will change. By analyzing emissions, data systems can be designed and planned to minimize carbon impacts over the life of the building.



Operational Carbon IV-2

Optimizing Systems for Internal Loads and Variable Occupancy: Changing loads within a building not only impacts total energy use but also the efficiency and effectiveness of HVAC systems providing space temperature control, humidity control, and ventilation. Most office leases currently require as much as 3 W/sf plug load allowance and/or a total plug + lighting allowance of 5 W/sf, while typical office spaces have operational plug loads of 0.34 W/sf to 1.53 W/sf. Many VAV systems are designed for a minimum constant lighting/equipment load and will over-condition or run inefficiently when faced with consistently reduced plug and lighting loads. Reductions in constant loads can also complicate the ability of some systems to effectively provide ventilation air without over conditioning and/or reheating.

Measurement and Verification: All energy systems change with time and use and must be continuously monitored, measured, and adjusted in order to maintain proper functionality and performance. Beginning with new equipment startup and extending through the life of building, the following scenarios generally require periodic evaluation & adjustments:

- HVAC equipment balancing, calibration, and sequences of operation
- Equipment failure & degradation
- Sensor calibration drift
- Operating hours & usage patterns

After the initial startup testing of equipment and systems, many building owners do not pursue on-going monitoring unless there is equipment failure or obvious operational flaws. Building operating and energy profiles are building-specific and highly dynamic, which makes data monitoring and collection an invaluable resource to better understand the performance of a building.

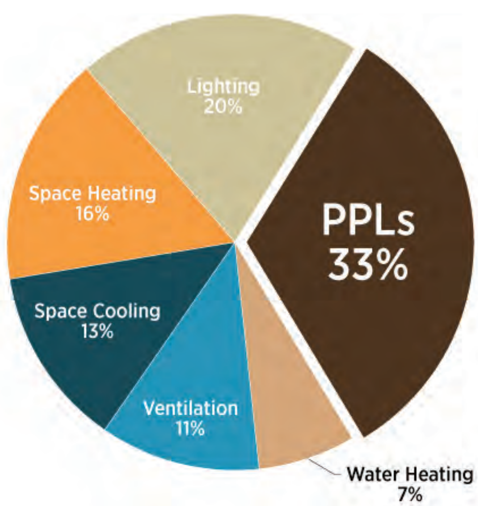
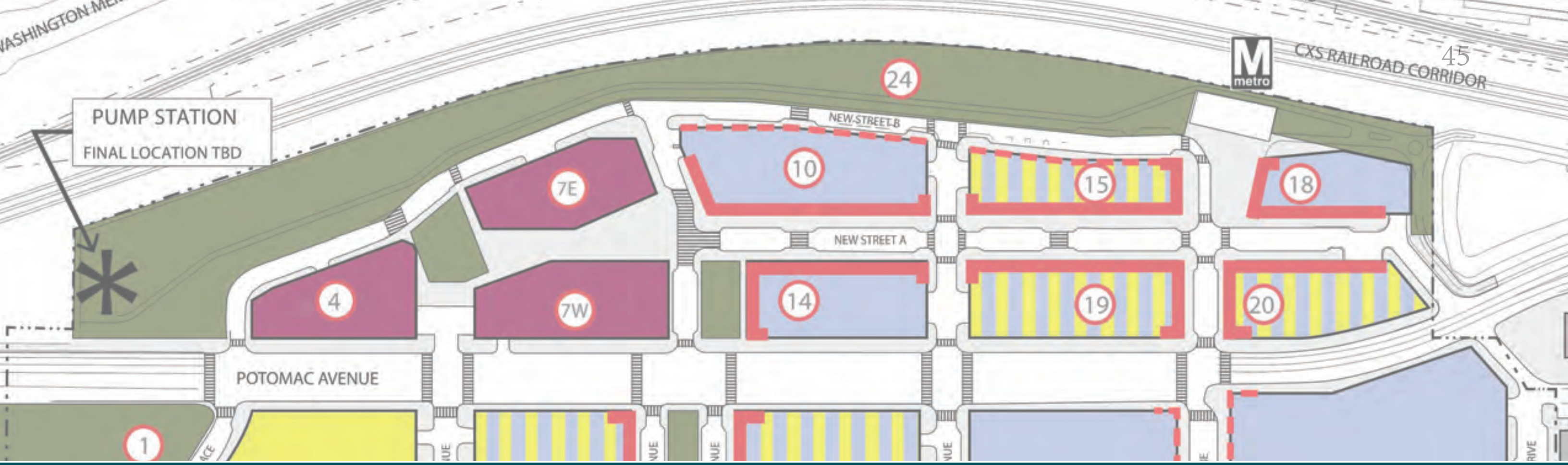


Figure 52. Plug loads can account for up to 1/3 of the energy use in commercial buildings.



Operational Carbon IV-2

GOALS

1. Design buildings that reduce internal loads, optimize ventilation, and balance performance with high indoor air quality.
2. Install systems that minimize Greenhouse Gas impacts on the neighborhood and region.
3. Go beyond energy and comfort standards while being responsive to changing demands and technologies.
4. Remain flexible in order to continually improve operational energy efficiency across NPY.

TOOLKIT

General Short-Term

- Develop a Zero-Carbon Analysis of representative buildings to evaluate the project for electrification, energy cost savings, renewable power, and any limitations (technology, cost, etc).

General Mid-Term

- Update the Zero-Carbon Analysis based on emerging technologies, cost, etc.

Passive Design and Envelope Optimization

Short-Term

- Meet or exceed ASHRAE 90.1-2013 Prescriptive performance requirements for all exterior opaque assemblies (wall, roof, floor, slab).
- Work to optimize glazing performance by analyzing options for: the glazing system U-value and SHGC, overhangs on south-facing glazing, dynamic glazing able to respond to both solar heat gains and glare, automatically-controlled shading able to respond to both solar heat gains and glare, and light shelves in open & regularly occupied spaces.
- Specify high-reflectance roofing with an SRI of ≥82 for low-slope roofs.
- Include toplighting that meets the prescriptive requirements of ASHRAE for minimum skylight fenestration area.

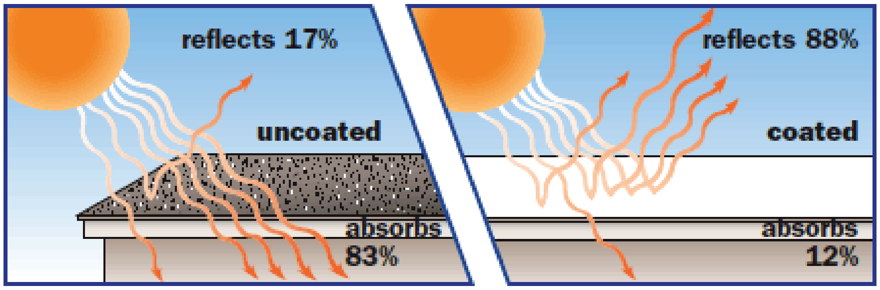
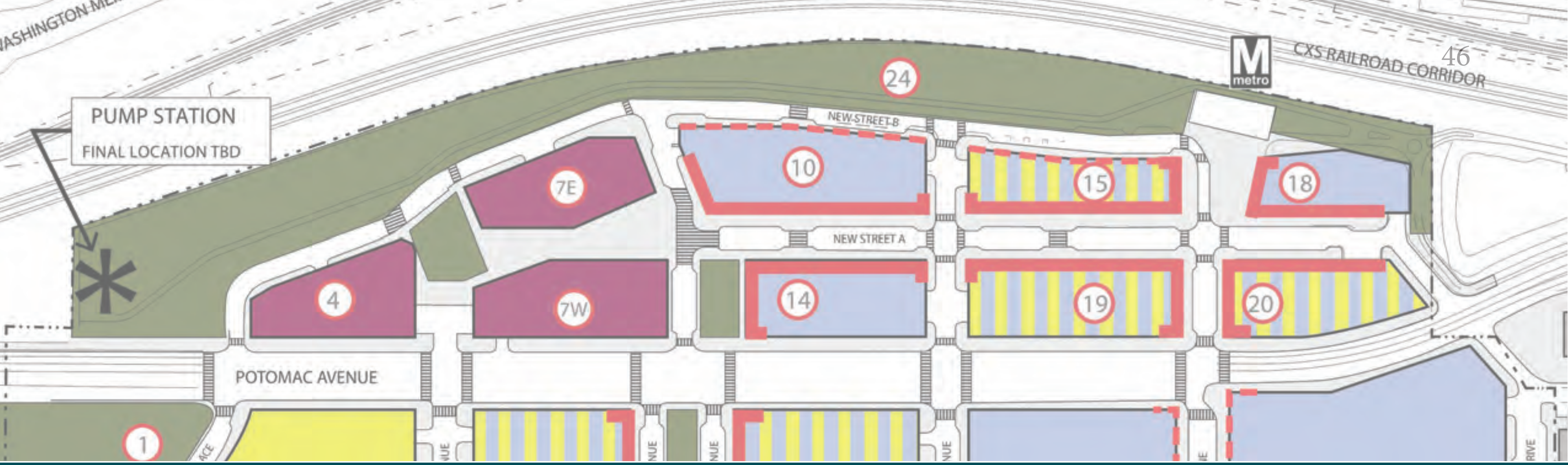


Figure 53. Reflective roof materials save energy by absorbing less heat

SHORT-TERM MID-TERM



Operational Carbon IV-2

Mid-Term

- Re-evaluate passive solar optimization based on current technologies. Adjust settings for dynamic glazing, mechanical shades, and daylight harvesting devices to optimize based on any changes to the building.
- Consider incorporating new technologies or existing technologies that may have become more widely used and cost effective including: dynamic glazing, passive daylight harvesting strategies, high efficiency window framing systems, and new advances in window coatings and IGU design.

Long-Term

- Re-evaluate passive solar optimization based on current technologies. Adjust settings for dynamic glazing, mechanical shades, and daylight harvesting devices to optimize based on any changes to the building.
- Consider incorporating new technologies or existing technologies that may have become more widely used and cost effective including: phase-Change Materials (PCMs) built into wall and roof assemblies and integrated solar photovoltaic films, glazing systems, and roofing options.

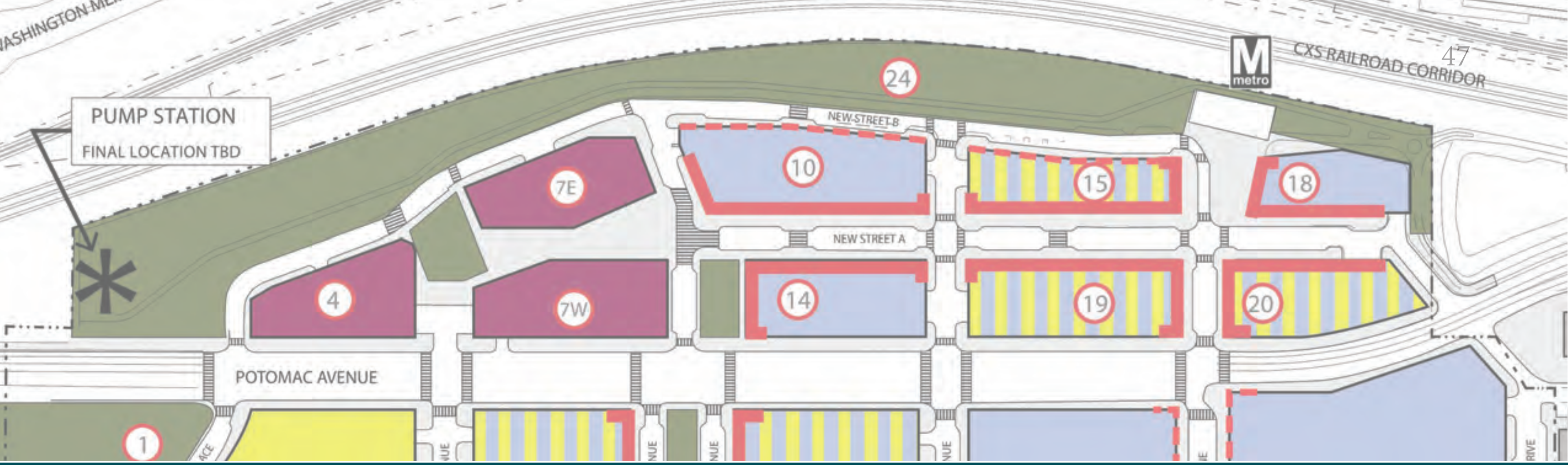
Internal Loads Optimization

Short-Term

- Define space-by-space lighting power targets at least 15% below the ASHRAE 90.1-2013 allowance.
- Design lighting based on IESNA footcandle guidelines and avoid excessive electric light levels.
- Specify all EnergyStar qualified appliances including refrigerators, dishwashers, washing machines, and dryers.
- Specify all hard-wired lighting as Energy Star LED (no A19 screw-in socket connections).
- Meet ASHRAE 90.1-2013 requirements for Hotel guest room controls.
- Exceed all ASHRAE 90.1-2013 automatic lighting shutoff/turn-on control requirements.
- Exceed ASHRAE 90.1-2013 daylight control zones for sidelighting and toplighting by 25%.
- Exceed all ASHRAE 90.1-2013 automatic plug-load shutoff control requirements and provide signage educating tenants about properly using occupancy-controlled plugs.

Mid-Term

- Provide end-use metering to tenants using a cloud-base app or website.
- Integrate smart plug-load controls with Hotel reservation systems that turn off unnecessary plug loads and lighting when rooms are not rented.



Operational Carbon IV-2

Long--Term

- Re-evaluate internal loads and controls based on current technology, which may include: fiber optic lighting fixtures and other means to deliver natural daylight deep into spaces with full necessary controls, and “biolights” or other light sources that do not require electric energy.

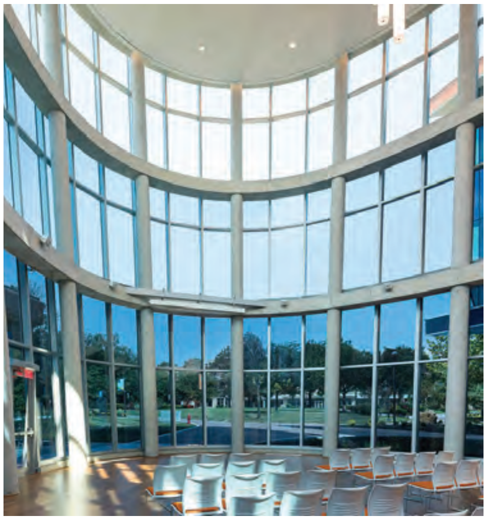


Figure 54. Dynamic and resposive glazing

Effective Ventilation Control and Design

Short-Term

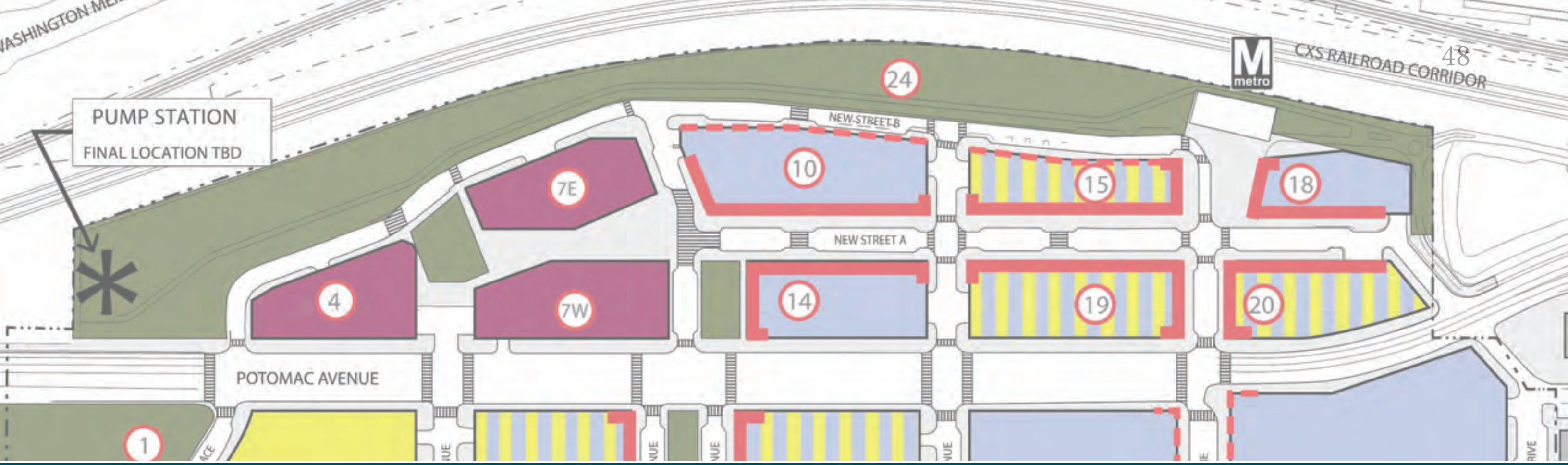
- Prioritize systems that decouple ventilation air and space conditioning (DOAS with distributed space conditioning systems).
- For Office uses, install dampers with EMS control for all OA boxes and incorporate DCV based on occupancy sensors (offices and small zones) or CO2 (high occupancy spaces such as conference rooms).
- Install motorized dampers with connection to EMS at all dwelling units or install appropriate infrastructure for future installation (power, control wires, dampers).
- Install motorized dampers tied into Hotel room master switch to shut off ventilation when unoccupied.
- Develop alternate control sequences and design systems to allow full shutoff of outside air when spaces are not occupied that can be deployed in the future.
- Utilize energy recovery for mechanical ventilation when feasible.

Mid-Term

- Adjust control sequences to shutoff outside air in spaces that are not occupied using occupancy sensors or other technology such as decoupled ventilation and VAV.
- Incorporate high-efficiency filtration and use testing-based methods to determine outside air volumes for VAV systems.

Long-Term

- Develop point-harvesting strategies to create real-time isolation zones based on measured occupancy and usage.
- Use AI for optimization of systems operation.
- Eliminate all outdoor air ventilation and instead maintain air quality by using a high efficiency hybrid filtration and purification system that eliminates particulates, microorganisms, and gaseous contaminants from indoor air.



Operational Carbon IV-2

Decarbonization-Ready Systems

Short-Term

- Prioritize selection of systems that minimize GHG emissions. If feasible, choose natural gas domestic hot water over electric resistance, natural gas heat over electric resistance heat, and heat pump heat over natural gas heat
- Design a central domestic hot water generated with gas-fired condensing water heaters.
- Pre-install necessary electrical connections and space allowances for future conversion to heat pump or other domestic water heating technology.
- Design a future-adaptable central heat pump hot water conversion to eliminate site natural gas usage.

Mid-Term

- Switch priority to electric heat over natural gas when eGRID CO2 generation falls below 450 lbs/MWh (accounts for typical efficiency of condensing gas boiler).
- Switch to heat pump hot water when appropriate based on technology or electric hot water when eGRID CO2 generation falls below 450 lbs/MWh.

Long-Term

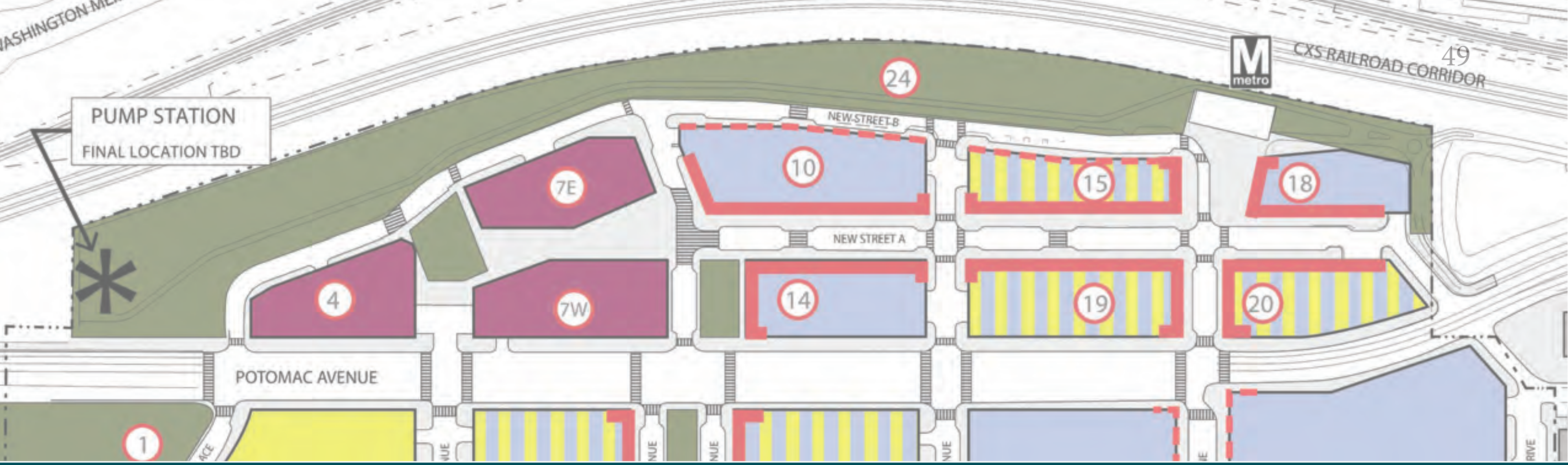
- Achieve zero fossil fuel usage.
- Harness the Potomac River or sewer reclaim for heat sink/source.

Optimizing Systems for Internal Loads and Variable Occupancy

Short-Term

- Design all systems to exceed zone isolation requirements of ASHRAE 90.1-2013, which requires the ability to isolate and operate separately zone groups based on occupancy and operation with the ability to isolate zones to 25,000 sf or less. For offices, exceed minimum by creating at least two isolation zones for each floor.
- Develop alternative VRP calculations for multizone systems to illustrate ventilation can be provided at reduced loads without reheat or overcooling.

Figure 55. Central domestic hot water



Operational Carbon IV-2

Short-Term cont.

- Develop alternative sequences of operation that can be customized to the loads, operation, and needs of different isolation zones.

Mid-Term

- Incorporate high efficiency filtration and use testing-based methods to determine outside air volumes for VAV systems.
- Re-evaluate needs, sequences, and schedules of new tenants any time a space is turned over and adjust sequences and equipment as necessary.

Long-Term

- Develop point-harvesting strategies to create real-time isolation zones based on measured occupancy and usage.
- Use AI for optimization of systems operation.

Measurement and Verification

Short-Term

- Meet the requirements of LEED v4 Advanced Energy Metering credit, capturing all individual end-uses representing 10% or more of the building's total annual energy.
- Plan for a scheduled review process to verify building operation using International Performance Measurement & Verification Protocols (IPMVP) that will use a Calibrated Simulation to account for actual weather and will adjust based on occupancy and operation.
- Install metering on all major central equipment (pumps, cooling towers, central water heaters, lighting, etc.).
- Design dwelling unit breaker boxes to group 110V outlets, lighting, and, appliances on separate breakers to allow for future metering.

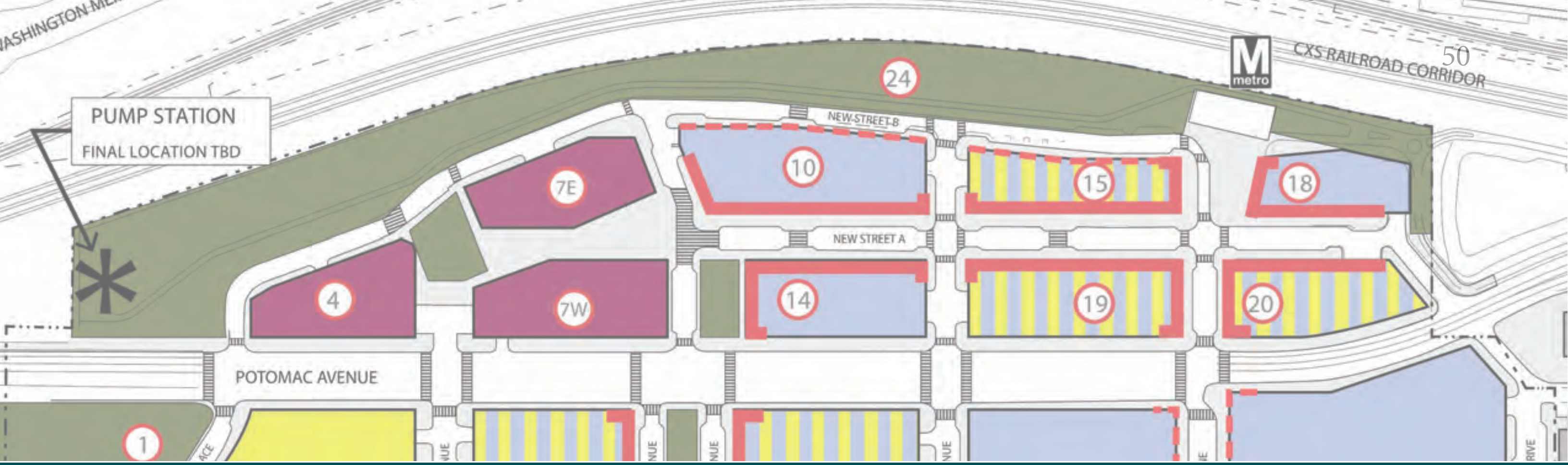
Mid-Term

- Regularly review building operation to verify performance.
- Mitigate any identified issues to maintain performance through sensor recalibration, equipment replacement, adjustment of sequences, retro-commissioning, or additional testing and balancing.

Long-Term

- Implement an automated continuous commissioning process.

SHORT-TERM MID-TERM LONG-TERM



Renewables IV-3

DEFINITION

Renewable energy refers to energy collected or generated from natural sources that are consistently replenished. Such resources include wind, water (rain, waves, tides), sunlight, and geothermal heat. Renewables present a way for NPY to transition away from traditional, carbon-intensive fossil fuel energy. Renewable energy includes approaches implemented either on or off-site, which combined can ideally provide all the energy a development needs resulting in decarbonization of the operational energy component of a building. Where this is not possible due to space, budget, or technology constraints, other strategies will be folded in to offset the more carbon-intensive energy uses of the development. Some examples of renewable energy strategies include:

- Photovoltaics (PV): the process of converting sunlight to electricity, primarily using silicon solar cells.
- Sewage Wastewater Energy Exchange (SWEE): the practice of extracting heat energy from sewage and recycling it back into buildings for heating and cooling purposes.
- Net-metering: a billing mechanism that credits renewable energy system owners for surplus electricity contributed to the overall grid.
- Power Purchase Agreements (PPAs): direct-supply agreements between a power producer (seller) and an end-user (buyer) related to a specific renewable energy project or projects. Financing, planning, installation and operation of the renewable energy project is handled by the seller.

Figure 56. Solar Photovoltaics

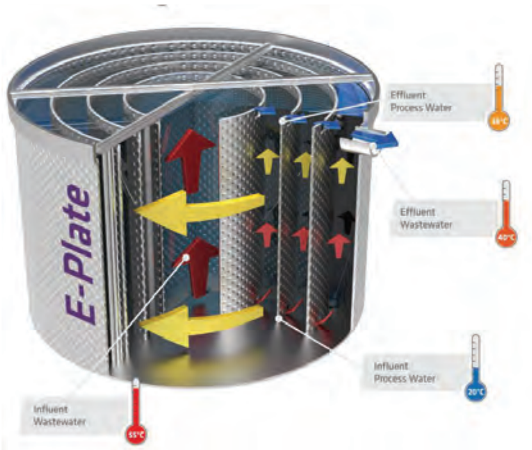
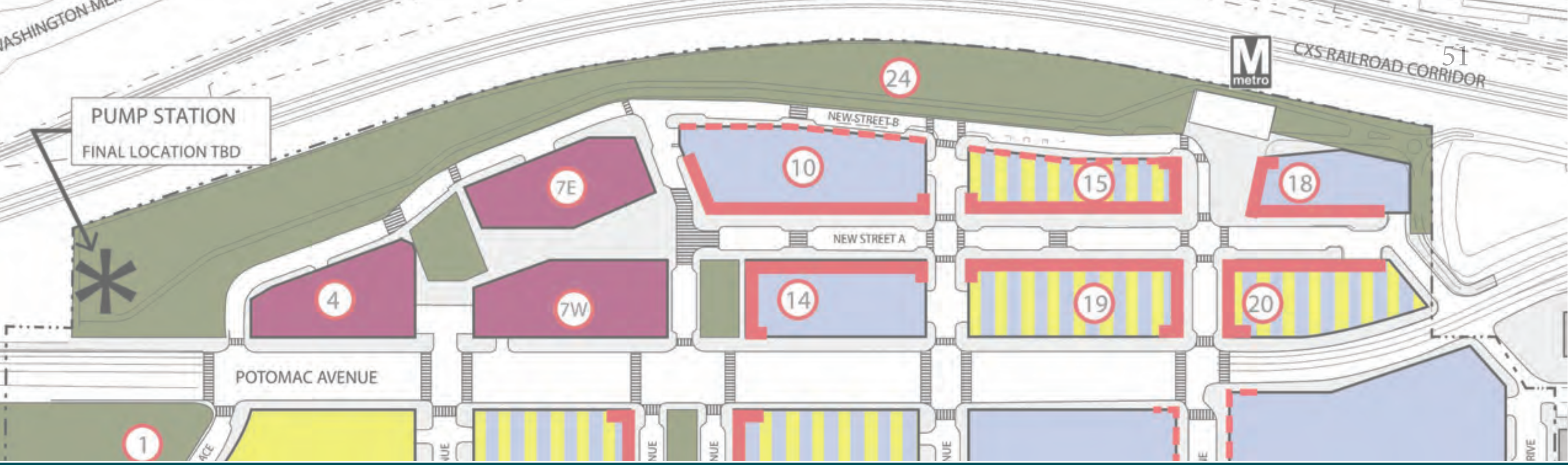


Figure 57. SWEE Heat Exchanger

GOALS

1. Capitalize on opportunities to transition away from traditional fuel sources.
2. Educate building occupants to promote success of transition to renewables.
3. Utilize multiple forms of renewable energy to maintain a diverse energy portfolio and work towards carbon neutrality by 2040.



Renewables IV-3

TOOLKIT

Short-term

- Install rooftop solar PV on academic buildings.
- Incorporate Solar Orientation Informed design techniques into design development phases.
- Provide infrastructure for future connections to a Sanitary Wastewater Energy Exchange (SWEE).
- Build accommodations for ground source heat pump infrastructure that is capable of being installed and expanded in the future.
- Purchase Carbon Offsets and RECs to supplement progress towards meeting renewable energy thresholds.
- Establish renewable energy usage goals and tools for tracking energy consumption over 5, 10, and 20-year periods to ensure future accountability.
- Partner with local schools on renewable energy educational materials.

Figure 58. Construction trailer PV

Mid-Term

- Enter into PPA contracts to offset a portion of fossil fuel use; ensure PPA contracts span a minimum of 7 years.
- Construct select building walls to be vertical PV-ready.
- Reserve space in buildings for battery energy storage.
- Install a SWEE to extract thermal energy from wastewater as an energy source for buildings.
- Utilize temporary PV and natural lighting for construction trailers and office space during construction phase.
- Construct residential building roofs to be PV-ready: have electrical infrastructure and mounting hardware in place for future installation of solar PV panels.

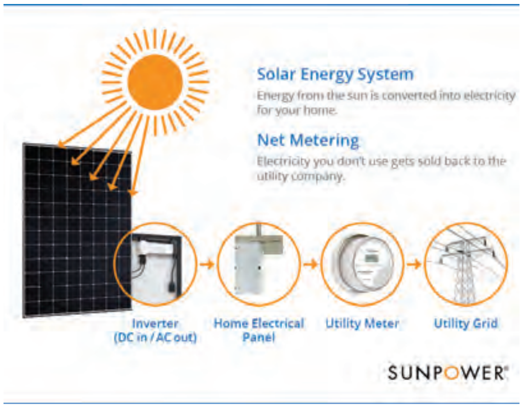
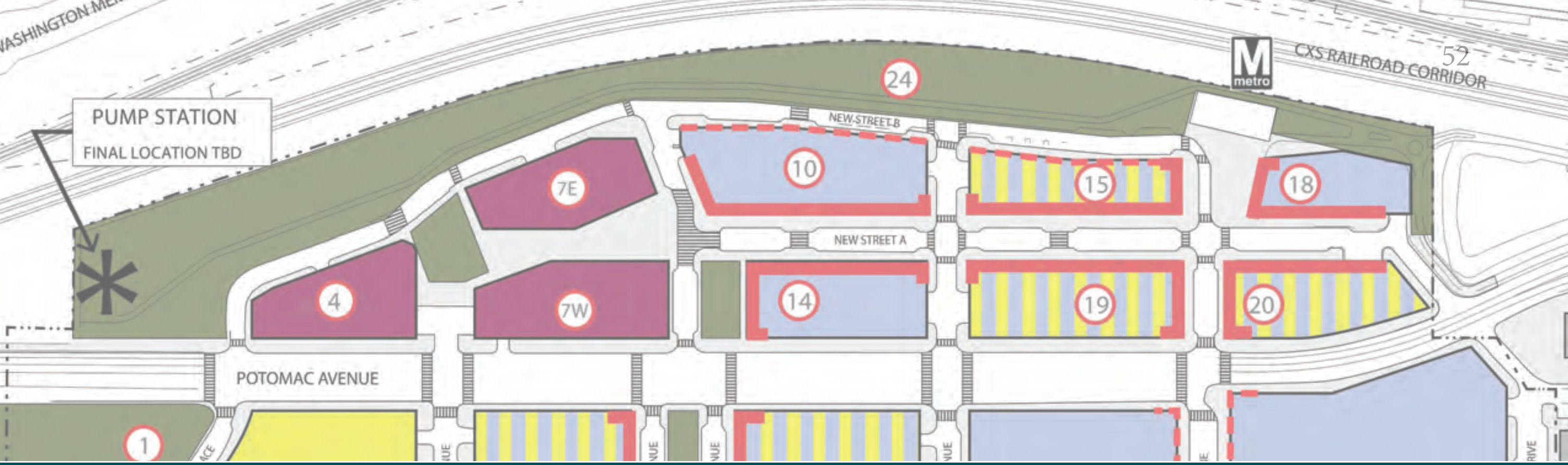


Figure 59. The Net Metering process



Renewables IV-3

Long-Term

- Reevaluate PPA contracts; extend the quantity needed to offset the remaining neighborhood fossil fuel usage after increases in electrification capabilities have been maximized.
- Collaborate with energy and LEED consultants to create educational program for occupants.
- Monitor energy consumption to project future load with building-level and unit-level metering.
- Add battery energy storage capabilities to buildings.
- Reevaluate the market viability of adding PV panels to residential buildings and install panels when cost-effective.
- Realize the full impact of the SWEE system through an increase in wastewater volume when future phases of development come online.

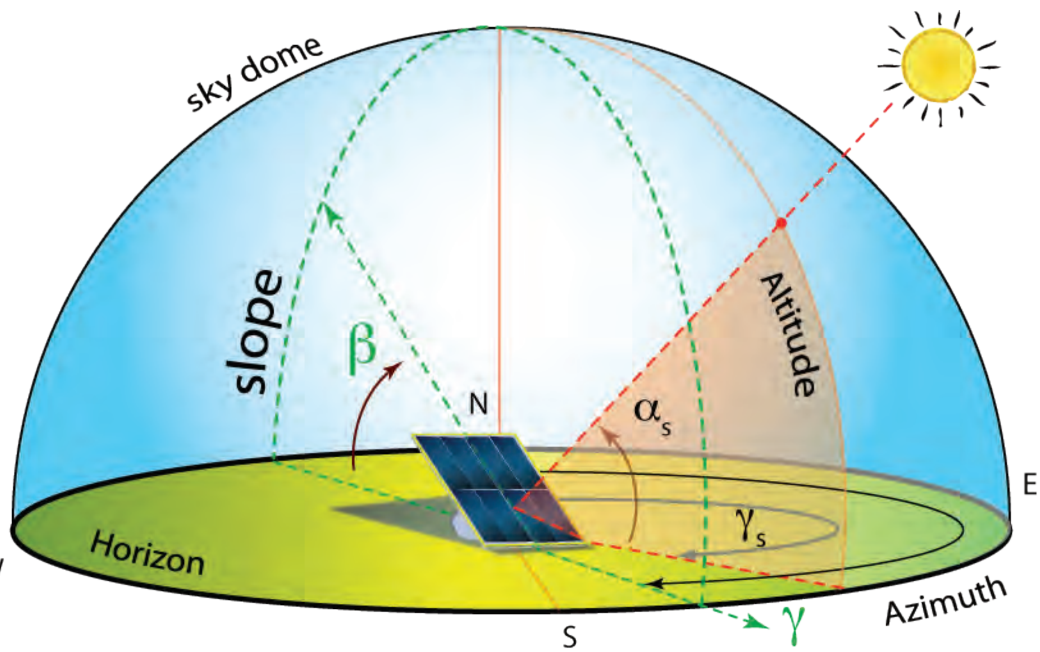
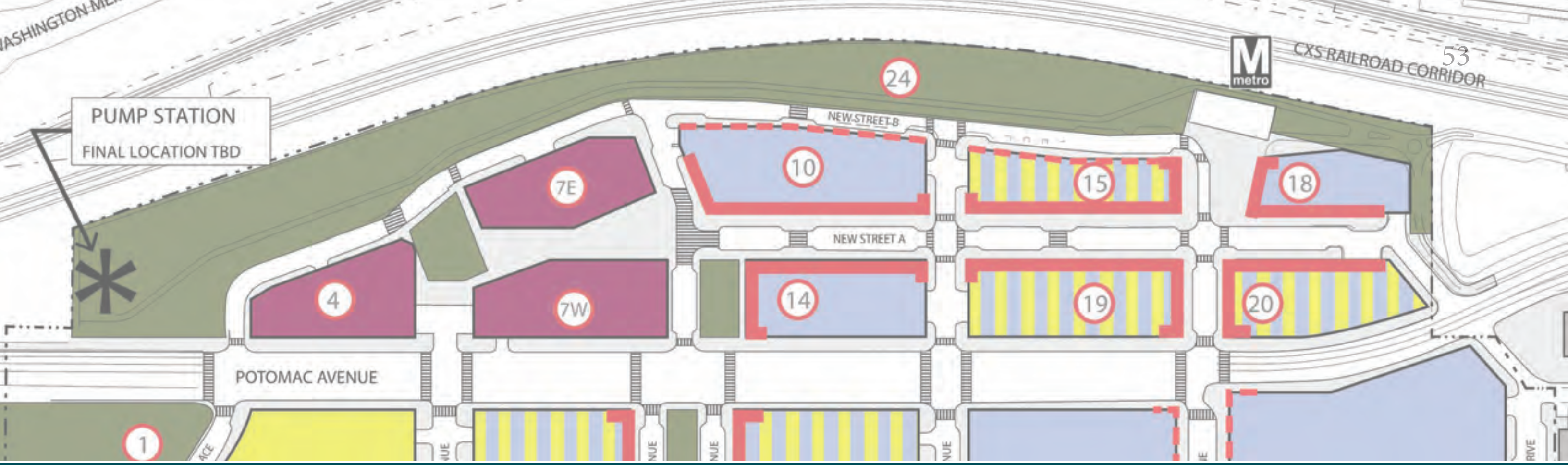


Figure 60. Solar exposure and orientation of PV panels



Transportation IV-4

DEFINITION

Transportation accounts for nearly a third of greenhouse gas (GHG) emissions in the United States[22], but by reducing the number of vehicles on the road this can be drastically reduced. Alternative transportation – transportation other than cars powered by fossil fuels – offers numerous decarbonization and environmental benefits. It reduces traffic congestion on roadways, thereby improving air quality and overall quality of life for commuters. The U.S. Department of Transportation reports that light rail produces, on average, 76% less GHG emissions per mile than the average single-occupancy non-electric vehicle[23]. Electric Vehicles (EVs) are transforming personal transportation, from manufacturing to maintenance, fuel consumption to automobile purchasing habits. EVs are expected to surpass traditional gasoline automobiles in the coming decades as their performance and range become more reliable. NPY is located in a transit-dense community, especially with the addition of the Potomac Yard Metrorail station, and has the opportunity to further increase transit options for its occupants and visitors. Walking and biking are truly carbon-free, resulting in lower infrastructure costs, less noise and CO_2 pollution, and improved physical and mental health. Creating a pedestrian and bicycle-friendly community will make these modes of transportation more appealing.

Most to least carbon-intensive modes of transportation:

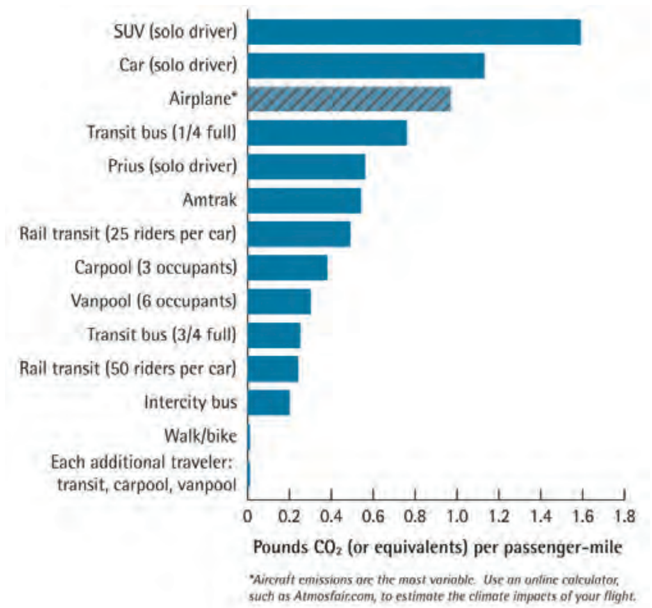
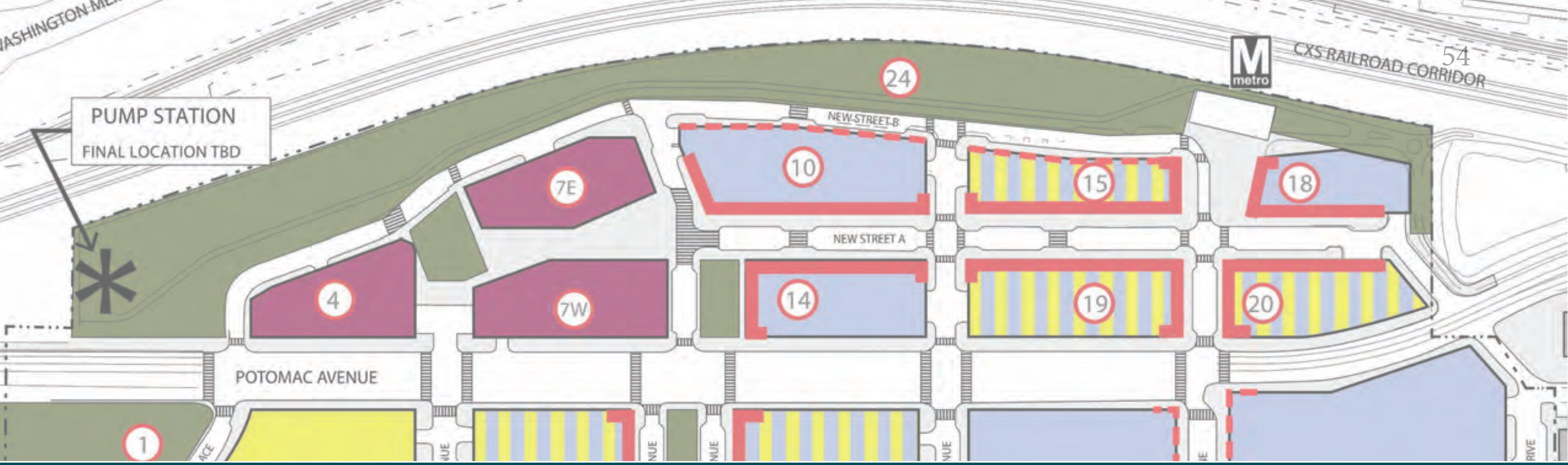


Figure 61. SightLine Institute



Transportation IV-4

GOALS

1. Prioritize low-carbon or carbon-free transportation infrastructure to reduce district-wide GHG emissions.
2. Reduce automobile dependency and increase convenient, accessible and affordable alternatives.
3. Maintain flexibility for expansion of low-carbon transportation options as technology and market conditions evolve.

Figure 62. Example WalkScore

TOOLKIT

Short-term

- Include EV charging infrastructure and ensure associated parking spaces are distributed equitably throughout the site.
- Install conduit/raceways to make future installation of charging stations easier.
- Reserve priority parking spots for low emissions vehicles and carpools.
- Calculate and make publicly available the WalkScore® of buildings in NPY.
- Incorporate secure, covered bicycle parking and maintenance stations.
- Consider providing at least one bicycle storage space for 15% of residents and enough for 5% of all nonresidential building FTEs.
- Design interconnected trails, sidewalks, and bike lane networks, including bridges and covered walkways if needed.
- Create physical or visual separation between vehicles and bicycle travel lanes.
- Place interactive digital transportation screens inside buildings and in public spaces.
- Provide accommodations for car share programs for use by neighborhood and City occupants.
- Establish a program for discounted transportation fees and discuss transit subsidy benefits with office and retail tenants.
- Designate carpool and rideshare pick-up and drop-off locations.

Figure 63. Bicycle storage for occupants

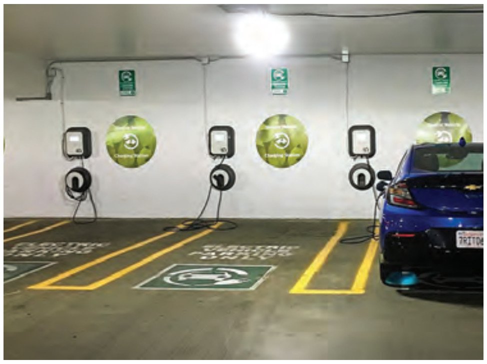
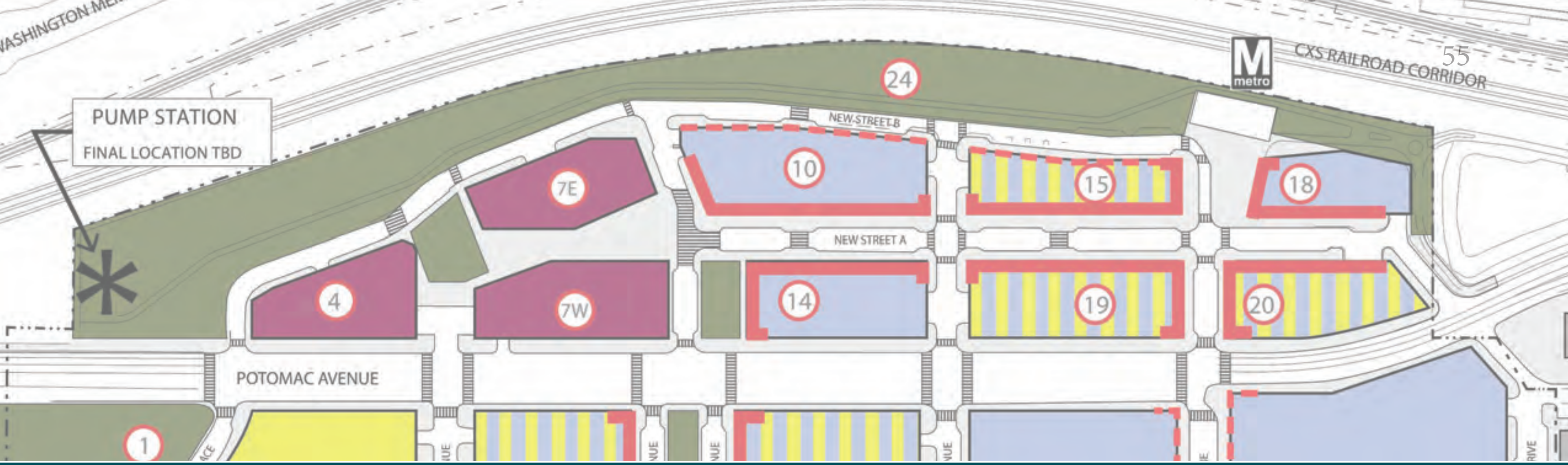


Figure 64. Charging and priority parking for electric vehicles



Transportation IV-4

Short-Term cont.

- Arrange regular shuttle service (using low- or no-emissions buses) to transportation and civic hubs throughout the region.
- Educate occupants on diverse uses in the neighborhood and respective biking/walking routes.

Mid-Term

- Monitor energy consumption for EV charging and regulate electricity sources to prioritize electricity for charging purposes.
- Eliminate parking subsidies or discounts.
- Reevaluate district transportation-related carbon emissions every other year.
- Conduct updated traffic studies to determine how vehicular usage has changed.
- Increase community-wide incentives for public transportation.
- Reduce new parking to 40% below the Institute of Transportation Engineers (ITE) guidelines.
-

Long-Term

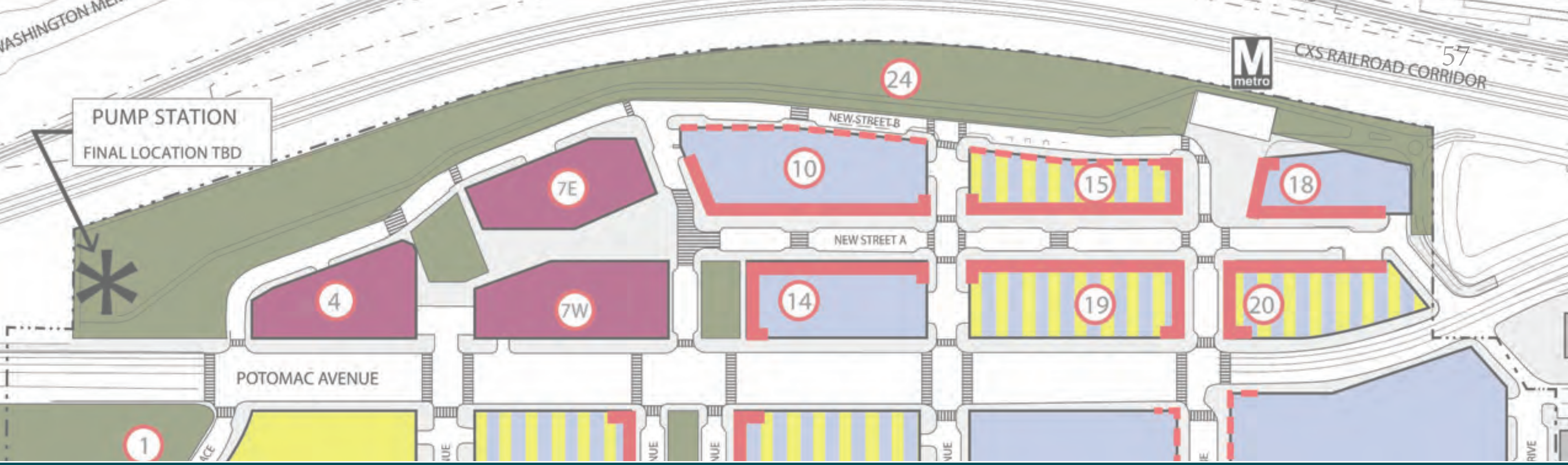
- Expand high-speed electric vehicle charging infrastructure and designated parking; implement an EV charging incentivization program to increase EV charging onsite.
- Reevaluate vehicle parking needs with each phase and avoid the addition of new, non-EV parking spaces as much as possible (target 50% below the Institute of Transportation Engineers guidelines).
- Create a platform for publicly tracking community EV usage.
- Conduct updated traffic studies to determine how vehicular usage has changed.
- Consider redesigning and repurposing vehicular rights of way to become pedestrian-oriented open space.

Figure 65. Tracking EV usage and associated energy consumption

Figure 66. Bus service and shuttle connections

SHORT-TERM MID-TERM LONG-TERM

HEALTH & WELLNESS



Health & Wellness V

BACKGROUND

This section focuses on the importance of occupant health and wellness and what can be done to improve experiences within the NPY buildings and at the district-wide scale. Sustainability not only includes environmental and economic sustainability, but social sustainability as well. Wellness is a key component of sustainable design, as the capacity to thrive is directly linked to our health and overall quality of life. Physical fitness, clean air and water, direct and indirect (visual) access to the natural environment, and the ability to choose conditions that suit our needs all play vital roles in social sustainability.

One of the three basic, but essential, human needs has been commonly defined as 'shelter'. We have become so akin with this resource that the average human spends approximately 90% of their time indoors. While our relationship with the indoors remains one of necessity, it has also evolved into one of enjoyment and recreation. NPY will be a community which celebrates this complexity and ensures that the internal, built environment will maintain the highest quality environment for its residents, tenants, staff, and visitors.

Figure 67. Elements of human comfort

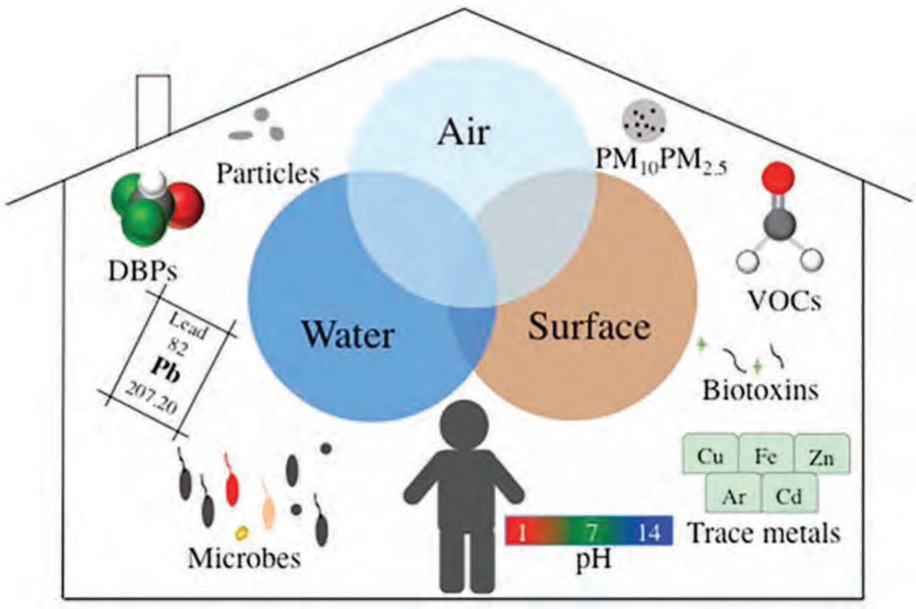
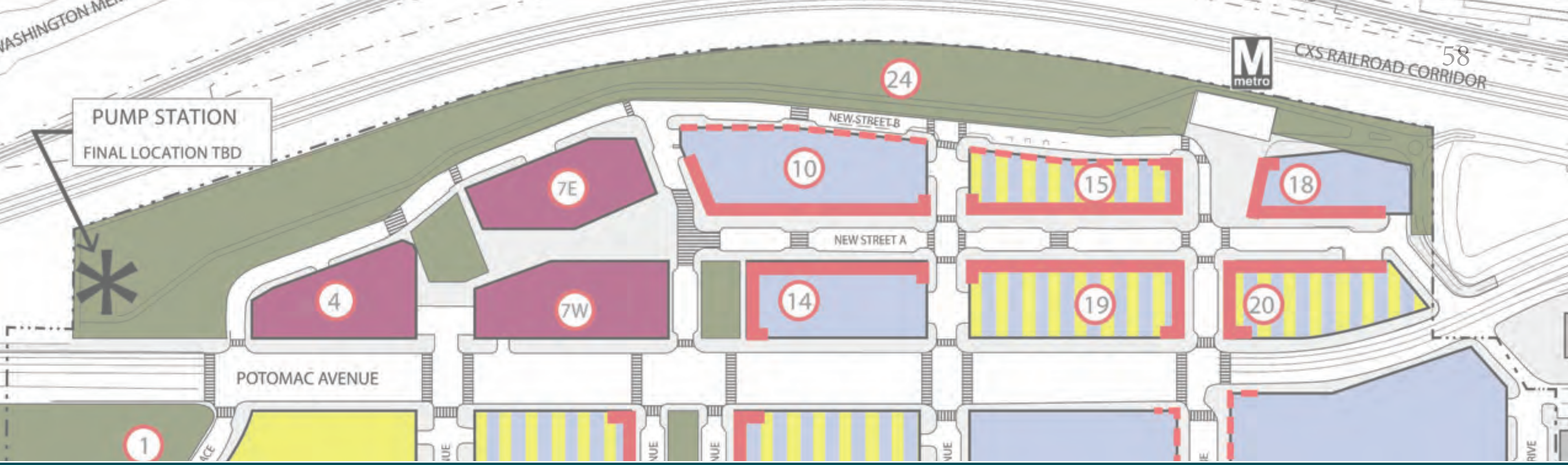


Figure 68. Impacts of indoor particulate matter on human health can be severe



Materials V-1

DEFINITION

When selecting structural and finish materials used onsite, it is important to evaluate the human health impacts they will have. Globally, the production of materials releases emissions that can be detrimental to human health. Locally, the health of building occupants can be directly influenced by materials used to construct the indoor environment. Selecting materials that optimize the user experience is essential to maintain the health and wellness of building occupants.

GOALS

1. Reduce interior emissions from materials used onsite.
2. Provide a natural indoor environment.
3. Specify healthy, low/no VOC materials and finishes.
4. Prioritize products with material transparency and product disclosure.

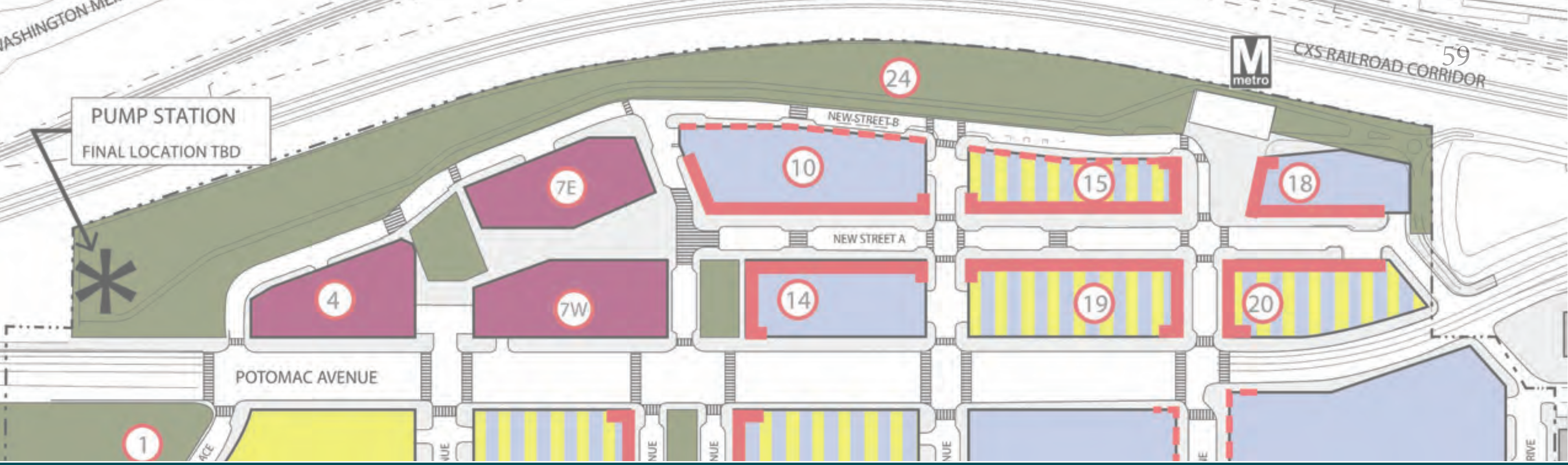
Figure 69. Choose products that disclose ingredients and health impacts

TOOLKIT

Short-Term

- Prioritize products that have disclosed their material ingredients and health impacts. These products have evaluated their ingredients and analyzed how they impact human health over the product's lifetime.
- Choose products with reduced life cycle impacts. These materials have Environmental Product Declarations (EPDs), which are product life cycle assessments that evaluate the product's impact on the environment over its lifetime.
- Prioritize products that have disclosed their emissions content and are compliant with VOC and TVOC emissions standards. These products reduce human health impacts from interior off-gassing of harmful chemicals.
- Build with resilient materials. Using sustainable materials that last longer will reduce the frequency of product replacement, which will decrease the emissions of VOCs and other chemicals in new materials.

SHORT-TERM



Materials V-1

Short-Term, cont.

- Conduct full building Life Cycle Assessments to consider the cradle to grave impact of the structural materials used on the project. The LCA will provide an evaluation of the buildings impact for 6 categories including global warming potential and acidification of land and water sources. All 6 impact categories have direct or indirect implications on human health.
- When designing the interior of the space, consider using natural materials such as wood or stone. Select naturally colored paint, maximize natural light, and include vegetation as a way to improve air quality. All of these aspects of biophilic design have been proven to improve the mental and physical health and wellness of building occupants.
- Use natural acoustic absorption materials such as green walls or non-natural materials such as ACT to optimize the user experience.

Mid-Term

- Use products that are adapted to the interior environment in which they are being applied. If installing carpet in an office, use carpet tiles, which can be easily replace if damaged. For residential buildings, use floor materials that can be easily cleaned to reduce the need for replacement, such as solid wood flooring or tile.
- Continue to conduct full building Life Cycle Assessments on future building designs.
- Assign a “Materials Manager.” Designate one individual, or a group of individuals, to be responsible for verifying all purchases of new materials on site. This individual should evaluate materials for their immediate and long-term impacts on human health.

Figure 70. Example EPD label

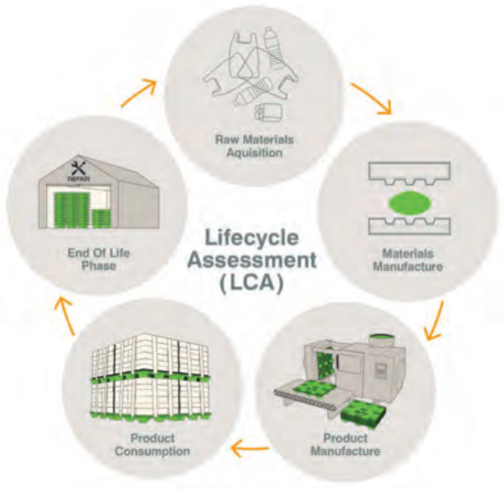
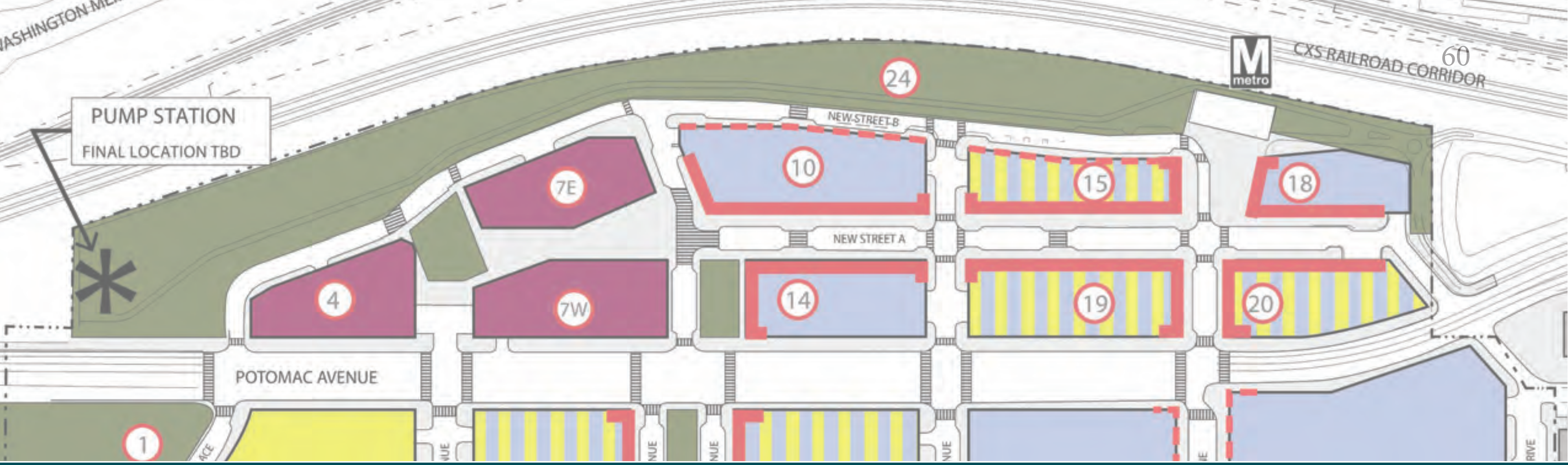


Figure 71. Product phases analyzed in an LCA

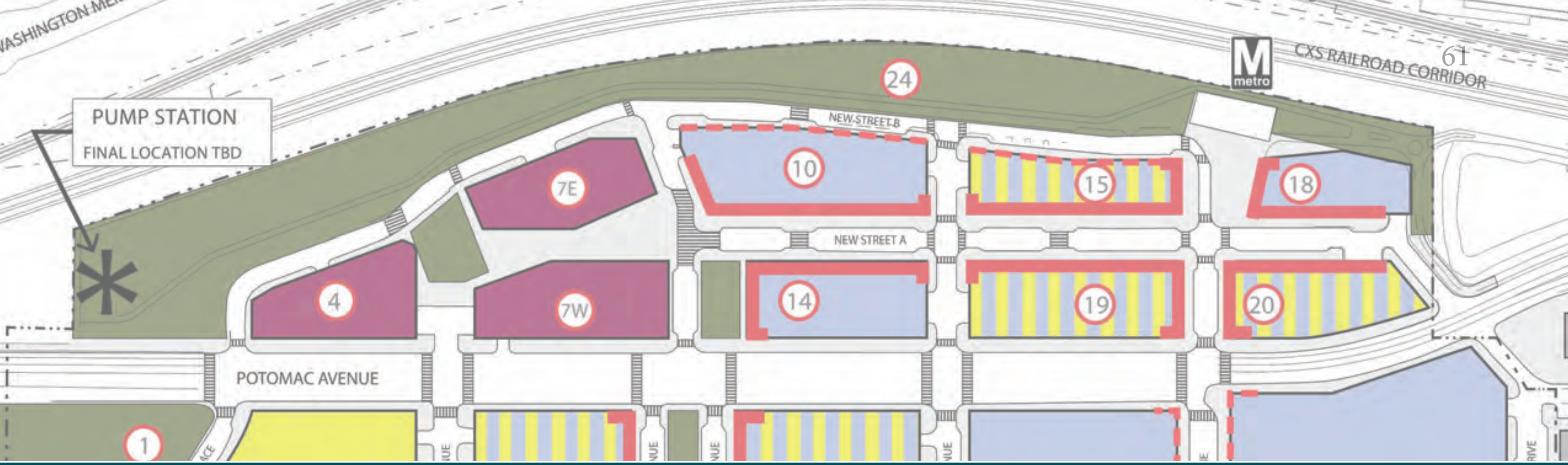


Materials V-1

Long-Term

- Create and implement a Material Replacement Policy. Set standards for replacing materials by determining a set of questions to ask the individual or tenant who is requesting the product replacement. Questions include: does the damage impact the functionality of the product? Can the product be easily replaced, or will it require a full replacement of an entire system?
- Be aware of, and adapt to, the changing industry standards around material health impacts and ensure new materials installed onsite comply with these standards.
- Continue to conduct full building Life Cycle Assessments on future building designs.

Figure 72. Biophilic design improves the mental and physical health and wellness of building occupants



Indoor Air Quality V-2

DEFINITION

The U.S. Environmental Protection Agency (EPA) defines Indoor Air Quality (IAQ) as "the quality of air within and around buildings and structures especially as it relates to its occupants."[25] The quality of air in buildings is dependent upon the air being delivered to the building from outside, and the maintenance of that air once it is circulated throughout the building. The most common factors that impact air quality include, but are not limited to: temperature, humidity, dust or Particulate Matter (PM), mold, Volatile Organic Compounds (VOCs), Carbon Dioxide (CO2), Formaldehydes (H2O2), and Nitrogen and Sulfur Oxides (NOx, SOx).

An essential priority of NPY is the health and well-being of its students, faculty, visitors, residents, tenants, and FTEs during construction and once the project is operational. Indoor air quality is a key component of a healthy neighborhood.

Figure 73. Typical IAQ pollutants

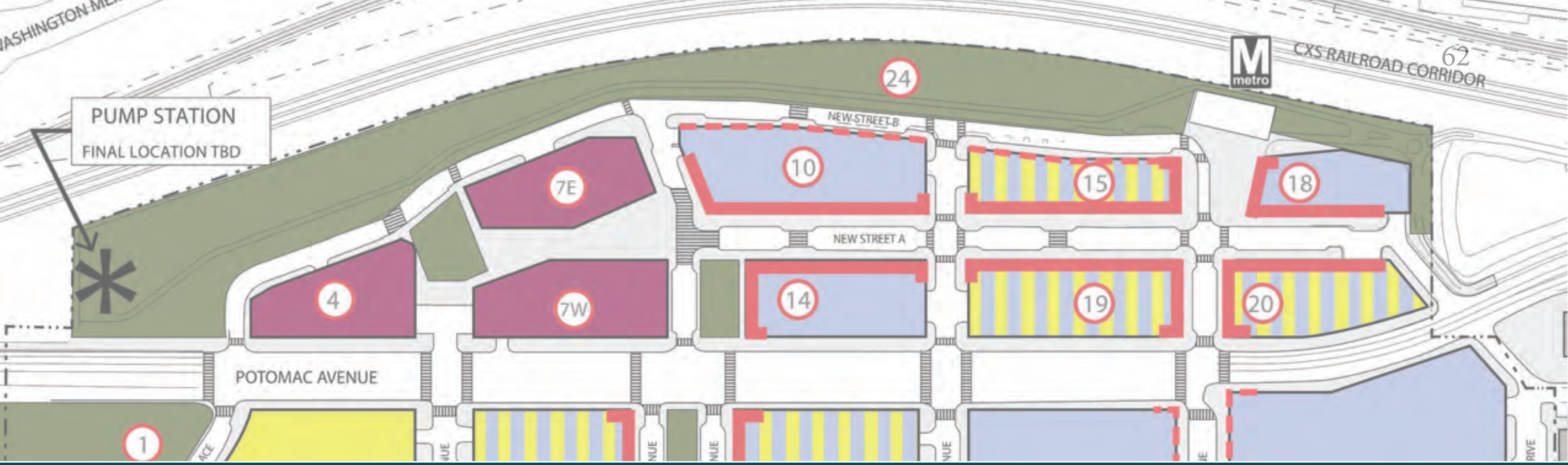
GOALS

1. Meet high environmental standards for ventilation systems, air filtration, and interior finishes.
2. Implement comprehensive plan for the monitoring and maintenance of IAQ.
3. Promote mental and physical health for building occupants.
4. Enhance community knowledge surrounding building functionality and smart IAQ practices.

TOOLKIT

Short-Term

- Develop a standard Construction Phase IAQ Management Plan modeled after SMACNA.
- Prohibit tobacco use on site during and after construction.
- Conduct regular sustainability and IAQ walkthroughs of construction sites
- Purchase only low or no VOC and NAUF products and materials.



Indoor Air Quality V-2

Short-Term, cont.

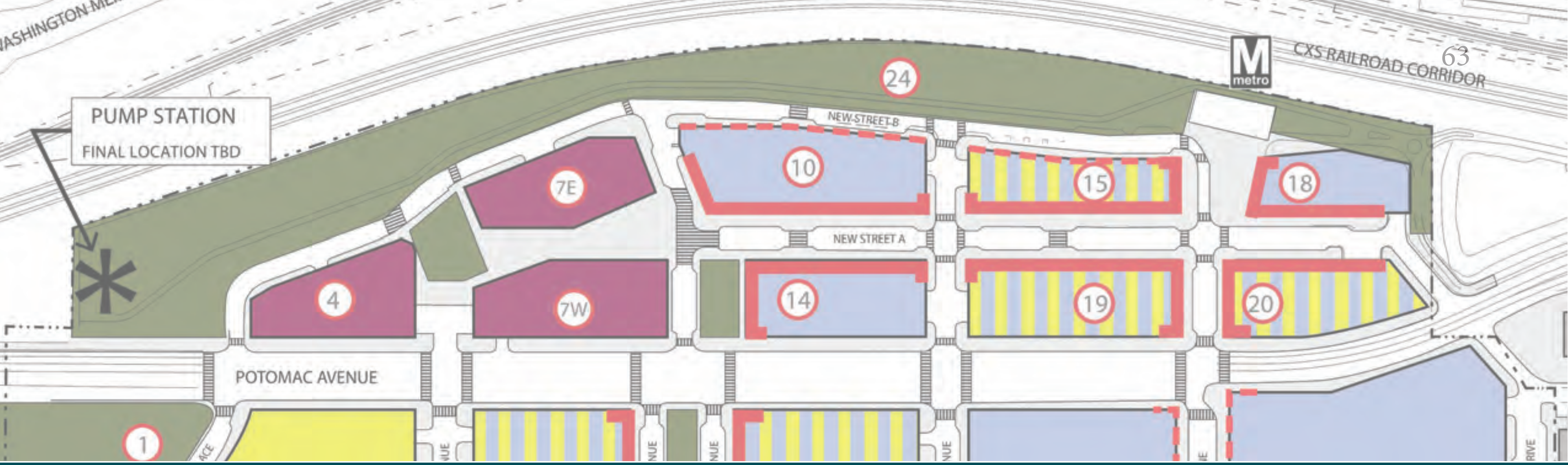
- Provide educational signage for occupants that explains what common practices and items often have the greatest impact on air quality (plants, candles, cleaning products).
- Establish green cleaning protocols that go above and beyond code.
- Establish a mandatory Integrated Pest Management (IPM) plan for all buildings and site area, which utilizes non-hazardous and naturally derived insecticides and herbicides.
- Furnish all building entrances (not just the main doors) with permanently installed walk-off mats.

Mid-Term

- Accommodate continuously monitored IAQ through software-connected remote technologies. Devices will be able to alert the responsible party if any air quality parameters exceed acceptable thresholds.
- Hold regular seminars for housekeeping staff to reiterate cleaning procedures.
- Replace all pre and final filters in applicable mechanical systems on an annual basis or once they are loaded.
- Meet or exceed the air leakage requirements established by the International Energy Conservation Code (IECC).
- Conduct annual air testing based on the parameters outlined in the latest version ASHRAE 62.1/62.2-Ventilation for Acceptable Indoor Air Quality in Commercial and Residential Buildings.
- Conduct semi-annual water tests of cooling towers and water features for Legionella.
- Regularly conduct visual inspections of HVAC equipment and ductwork for dust, debris, mold growth, and moisture build up and outline standard practices to react to these factors.
- Ensure building Engineers are given the educational and technological tools to improve building IAQ and performance.
- Record instances IAQ complaints in the building to quantify occupant satisfaction and target areas for improvement.
- Achieve the WELL Standard requirements for air quality by testing for more stringent levels of the following parameters: VOCs, PMs and Inorganic Gases, Radon, and Ozone.

Long-Term

- Establish and refine an informational program which educates occupants on the mechanical functionality of the buildings within NPY and fosters smart practices and habits to maintain a high level of air quality.
- Publish results of IAQ and Legionella testing and make publicly available for occupants to review.



Comfort V-3

DEFINITION

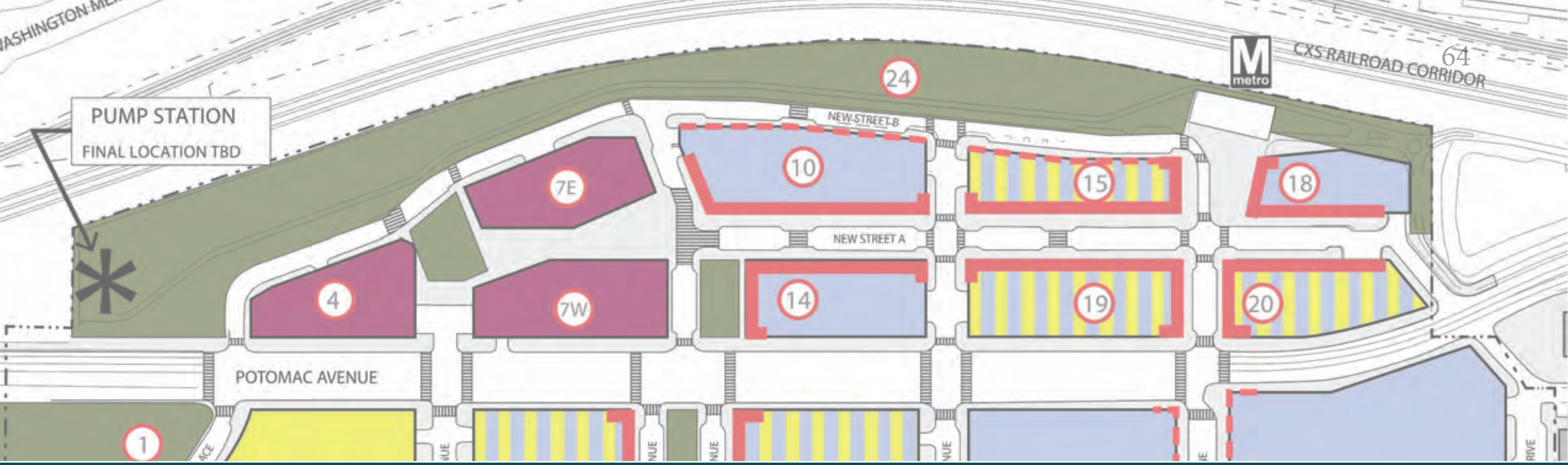
Natural Lighting: Lighting influences on the cognitive function and regulate the body to prevent depression. Natural Lighting creates an optimal environment to improve the visual experience and health of the individual. Daylight access can influence the productivity and mood of individuals and help with the sleep/wake cycle. Circadian lighting mimics this natural cycle with the transition of light color throughout the day. Influences from cooler colored lights can impact the naturally occurring melatonin in our bodies and disrupt the normal sleep cycles. These concepts can improve health particularly for individuals that suffer from Season Affective Disorder, Post Traumatic Stress Disorder, dementia, and sleep disorders.

Access to Nature and Restorative Spaces: A view to nature can enhance our creativity and provide restorative healing effects. Biophilic elements have demonstrated improvements in productivity, emotional welfare. The environment we live in can influence the level of stress and promote creativity. Integrating plants, water, light and views, and indirect access to nature using natural materials, patterns, colors or images is the design strategy behind biophilia.

Thermal Comfort: The spread of disease more likely in environments that are extreme temperatures and humidity. Thermal comfort is very personal to the individual, but can be improved with the occupant capability to adjust the thermal environment. ASHRAE Standard 55 was developed specifies conditions for acceptable thermal environments in buildings. Using guidance for appropriate design conditions within this standard can help with the framework for environments with improved thermal comfort and improve the occupant health and perception of comfort.

Fitness: Physical activity has numerous benefits that go beyond improved health and weight loss. Regular exercise can improve balance and reduce stress. It can provide an avenue to socialize or provide an opportunity for centering the mind. Providing multiple opportunities for occupants to move and elevate their physical activity will improve the occupant health and wellbeing. Proper hydration can improve cognitive ability and function.

Figure 74. Natural lighting in buildings helps to create an optimal environment



Comfort

V-3

GOALS

1. Prioritize a high level of occupant comfort control over interior spaces.
2. Promote opportunities for interaction with nature and biophilia.
3. Optimize lighting conditions for all occupants through innovate practices spanning daylighting, light quality, and circadian rhythm impacts.

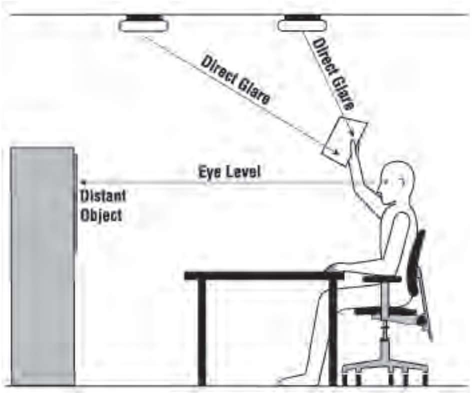


Figure 75. Glare produced by lighting

TOOLKIT

Short-Term

- Optimize regularly occupied spaces to natural light. Orient areas for maximized congregation and time spent to be in close proximity to building perimeter.
- Target a visual light transmittance greater than forty percent for glazing (VLT >40%).
- Install glare control devices to be installed on spaces with high incidence of solar exposure.
- Electric lighting requirements to install all LED lighting with color rendering index of at least 90 (CRI >90).
- Install daylight controls to turn on electric lighting only when natural lighting is not sufficient.
- Design stairs to be more prominent than elevators.
- Design to include biophilic elements in each regularly occupied space (plants, water, art, materials).
- Provide rooftop and courtyard garden spaces that provide respite opportunities for occupants to connect to nature. Plantings should provide visual interest year-round, if possible.
- Orient areas for maximized congregation and time spent to be in close proximity to building perimeter with unobstructed views to the outside.
- Include indoor plants in common spaces and transitional spaces to provide connection to nature for areas without views.
- Provide water features that provide sound masking and introduce a visual element of movement.

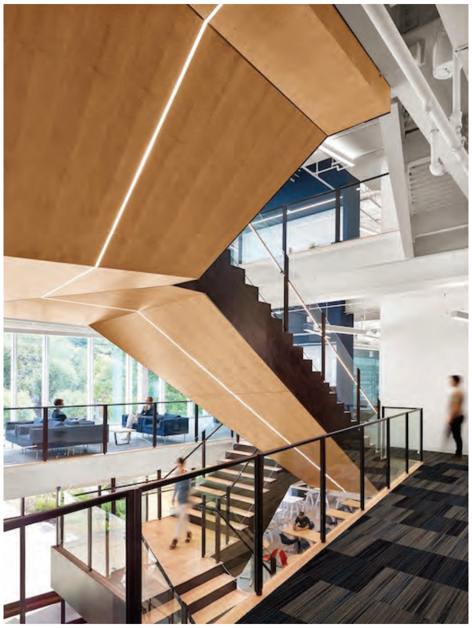
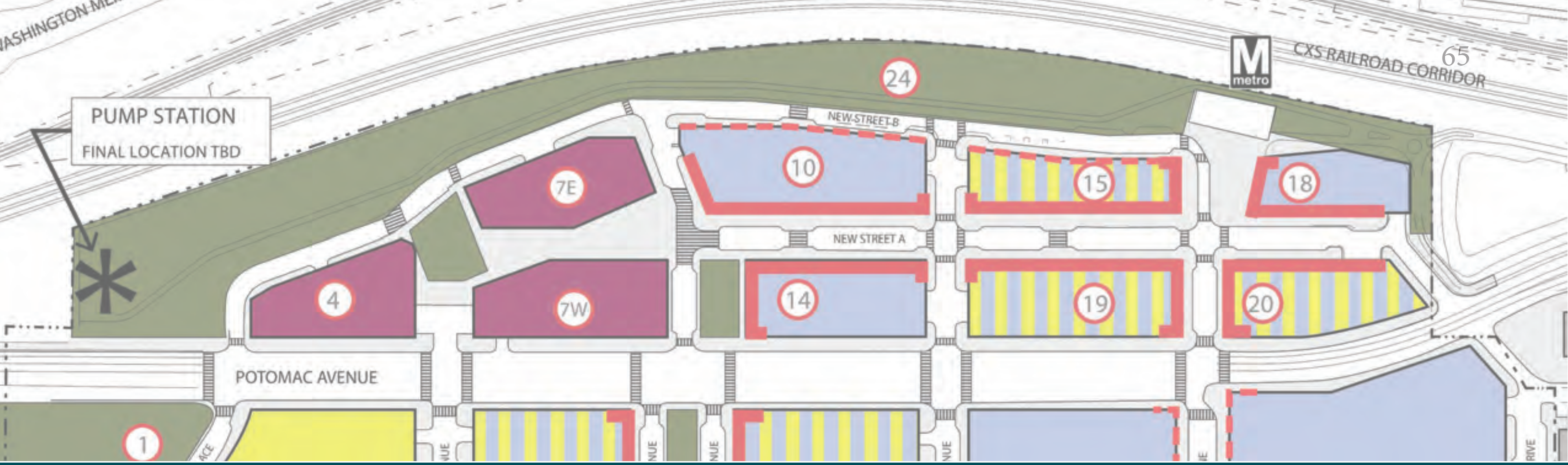


Figure 76. Prominent staircases encourage occupants to be more active by taking the stairs rather than the elevator.



Comfort V-3

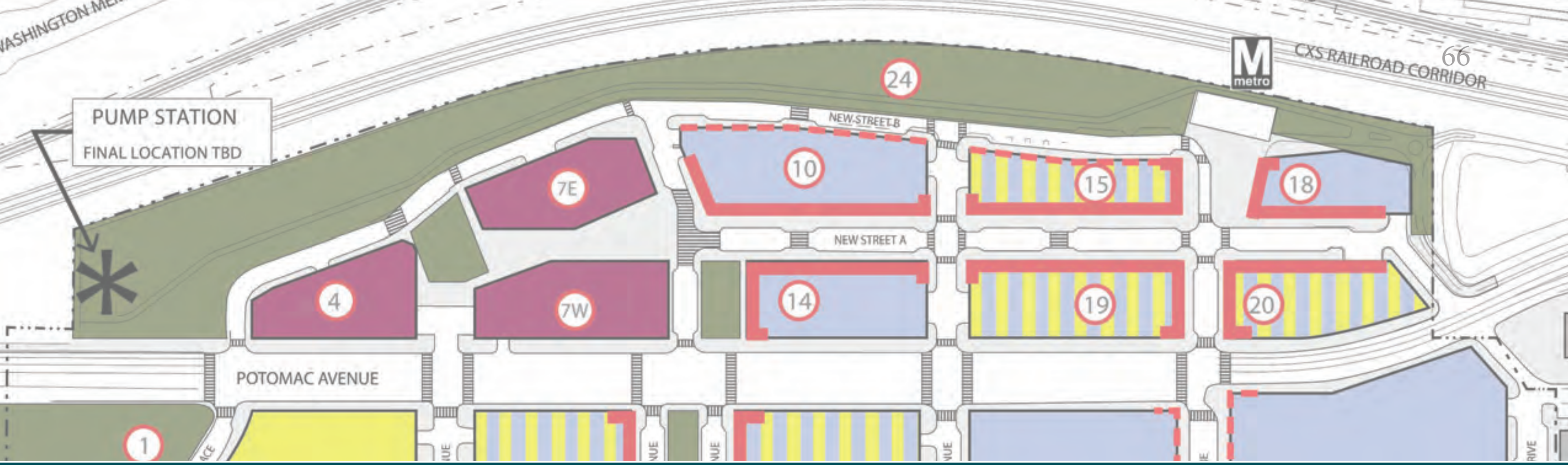
Figure 77. Operable windows allow for natural ventilation

Short-Term, cont.

- Support controllability through smart thermostats. These devices are capable of learning habits and providing remote control.
- Provide operable windows for opportunity to experience natural ventilation.
- Add CO2 sensors in densely occupied rooms to notify occupants when fresh air is needed.
- Use humidity control devices set to modulate relative humidity between 30-60%.
- Dedicate interior and exterior space for physical fitness, recreation, and game activities.
- Provide exercise equipment that includes muscle-strength and cardiorespiratory equipment.
- Equip bicycle rooms with bike parking, showers, changing rooms, and bike repair equipment.
- Provide occupants access to at least one staircase that extends the height of the building.

Mid-Term

- Design light shelves, skylights, and light tube systems into future buildings.
- Install circadian lighting in bedrooms.
- Develop quiet areas and alcoves, especially areas with tree canopy coverage.
- Continuously monitor main thermal comfort parameters. Provide multiple sensors and record trends for the following: dry-bulb temperature, relative humidity, air speed and mean radiant temperature.
- Provide service request process where occupants can identify issues via application to directly notify management of maintenance issues.
- Zone office workstations to provide thermal comfort controls for all workstations.



Comfort V-3

Mid-Term, cont.

- Design the site and buildings to include transitional indoor/outdoor exercise space. Encourage occupant use by enhancing the exercise experience with access to natural light and air.
- Install whole building sediment water filtration systems.
- Test building water quality annually.

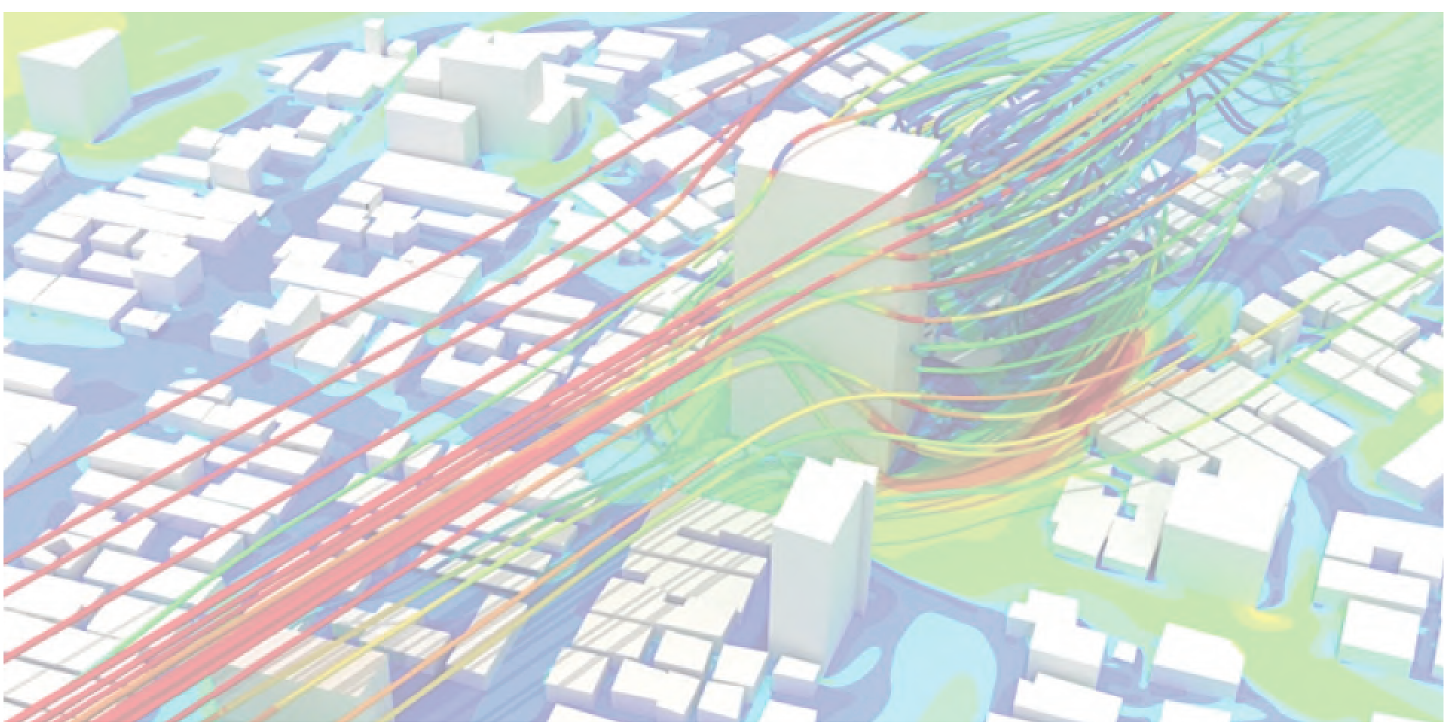
Long-Term

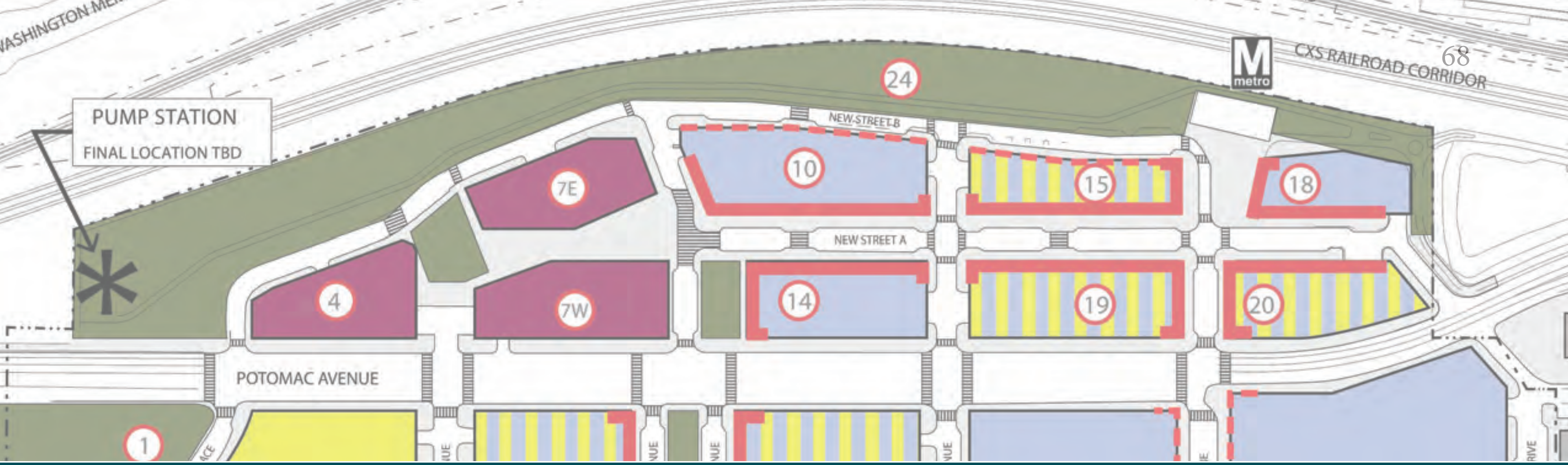
- Install full circadian lighting systems. Cycle lighting to include cool white during daylight hours to suppress melatonin growth and keep occupants more alert and active. Transition lighting to a warm white color in the evenings to promote melatonin and help occupants relax.
- Provide stipends for adventure or nature trips to encourage opportunities to connect with nature.
- Implement smart-home system integration, including smart thermostat controls, geofencing capability, scheduled setpoint assistance, shade integration, and remote capability.
- Seasonally survey occupant comfort level.
- Provide regular physical fitness and mindfulness educational classes to building occupants.
- Provide virtual instructor-led training programs.
- Install whole building UV water filtration system.

Figure 78. Circadian lighting is designed to follow the human circadian rhythm


RIVER POST
HC1
In this typical cross section diagram of the Living Shoreline design for Haven Creek, note how:
Typical Living Shoreline Section
Shoreline Functions
HABITAT

RESILIENCE





Resilience VI

BACKGROUND

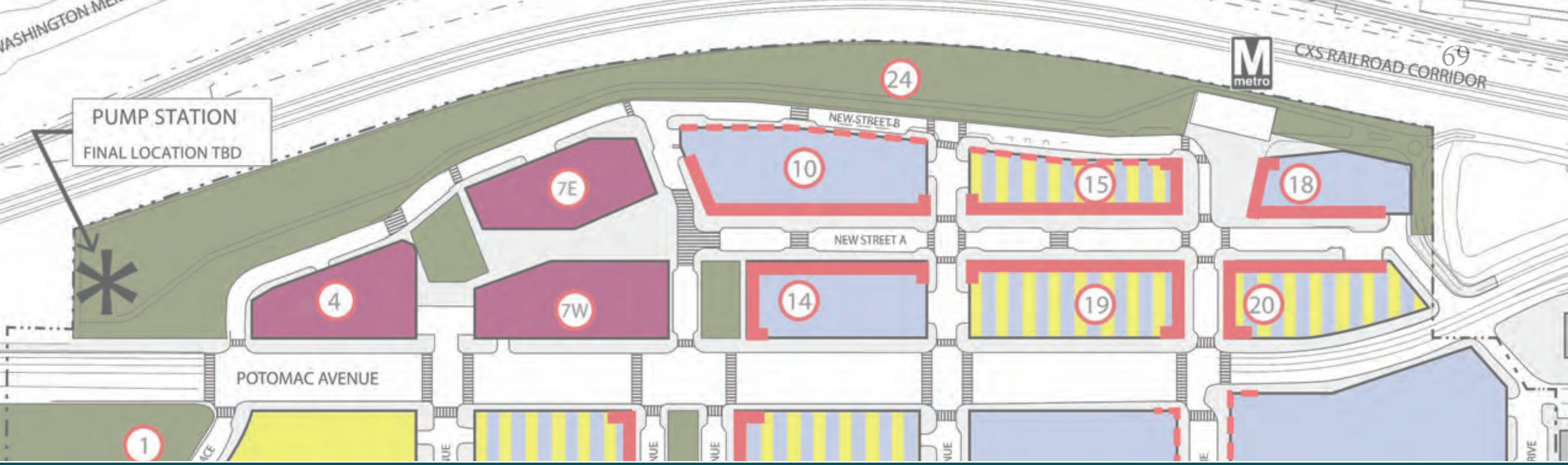
The expansion of urban environments over the last century has drastically increased atmospheric levels of greenhouse gases. Buildings use approximately 40% of total global energy and are responsible for 30% of greenhouse gas emissions[26]. One effect of this rapid increase in CO2 is that extreme weather events have become more common and destructive. Global temperatures have steadily risen, water bodies have become more acidic, and snow cover has decreased. Our area experiences, and will likely continue to experience, an overall increase in extreme weather conditions and storms: heat stress, flooding, and storm surge, in particular.

In response to the rapidly changing climate, North Potomac Yard will practice resilience on a site-wide scale. Resilience is the process of adapting to environmental changes while maintaining essential functionality. Although emergency response protocols are important, equipping the neighborhood with resilient infrastructure as a preventative measure will go further to help NPY withstand unpredictable future environmental challenges. The site will become a protective environment for its community members by incorporating equipment and systems to prepare for urgent, unpredictable events.

The ESMP focuses on five interconnected resilience themes: products/manufacturers, essential systems and equipment, adaptable buildings, an evolving site, and community. Balancing flexibility and adaptability with prevention and redundancy will be important in achieving a resilient neighborhood with infrastructure that can stand the test of time.

Figure 79. Windmill Hill Park shoreline

26. “Why the Building Sector?,” Architecture 2030



Infrastructure VI-1

DEFINITION

Resilient infrastructure begins with preventative measures that can decrease the environmental risk to the project investment. It includes implementing measures that will help mitigate climate change risks while also designing for the project to withstand and weather through difficult environmental conditions, especially as the climate changes and natural disasters become increasingly unpredictable. Resilient infrastructure also includes designing robust and resourceful systems that can provide safety and stability for occupants in the case of natural disaster emergencies.

GOALS

1. Develop a resilient community capable of withstanding changing weather patterns.
2. Implement a palate of durable, long-lasting, and natural materials to prolong the longevity of building and site elements.
3. Prioritize flexible spaces capable of operating passively to provide basic functions in case of emergency: light, heating/cooling, water, and comfort.

Figure 80. Battery bank

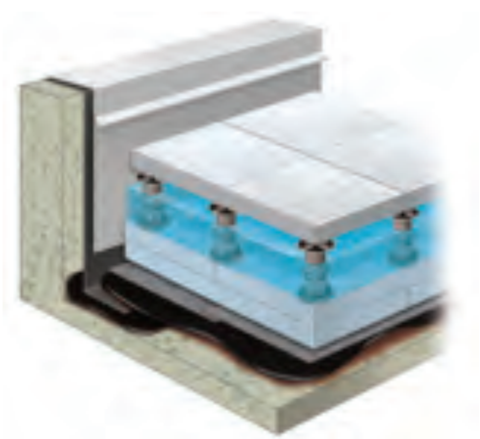
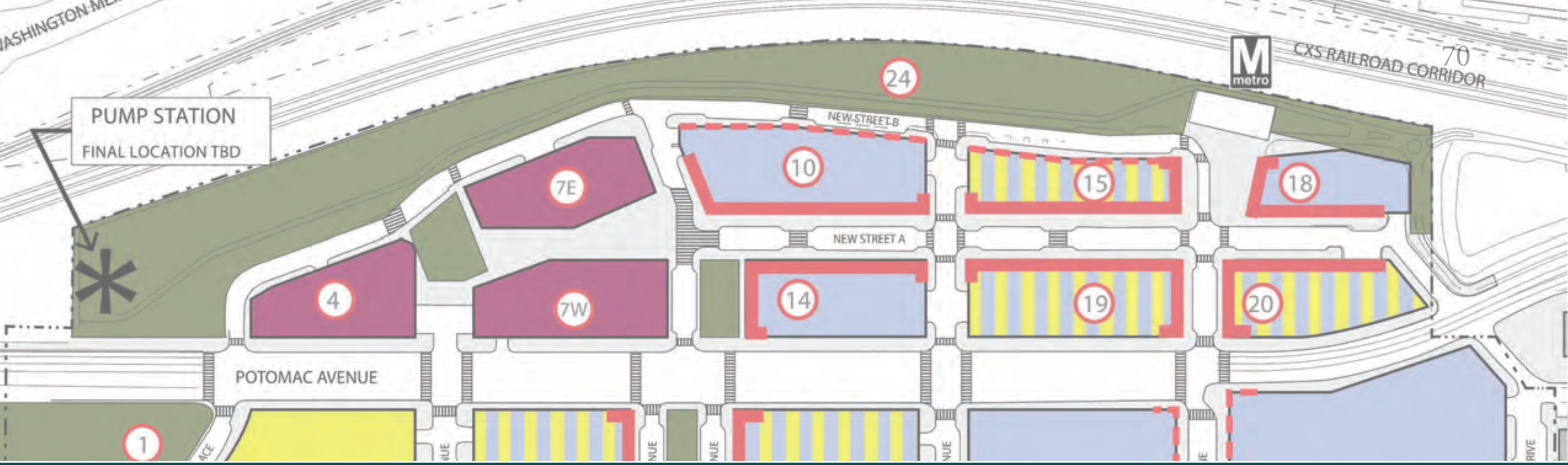


Figure 81. Blue Roof cross section

TOOLKIT

Short-Term

- Design the district to account for current flood zones and possible future flood zones based on FEMA projections. Specific strategies may include programming high-risk zones as riparian or vegetated buffer with limited access to pedestrians.
- Use materials such as brick and stone for building and site elements that are long-lasting and timeless.
- Select products that can be re-used or recycled in the event of degradation, destruction, or deconstruction.
- Mass and orient buildings to promote and create air movement for pedestrian comfort; consider shape and adjacency to other buildings.



Infrastructure VI-1

Short-Term, cont.

- Protect critical equipment and systems from the 500-yr flood and 2-3 ft sea level rise. Systems and equipment may include back-up generators, switchgear, pumps.
- Plant large-canopy tree species at regular intervals to provide places of respite from the heat and sun.
- Provide flexible space(s) that can transform to evacuation areas.
- Design for integration of on-site renewables in the future; ensure roof designs can support photovoltaics.
- Design flexible spaces for aging populations, disabled occupants, and changing needs in multifamily buildings. Elements include levers, handles, switches; movable, adjustable cabinets; turning radius, opening widths.

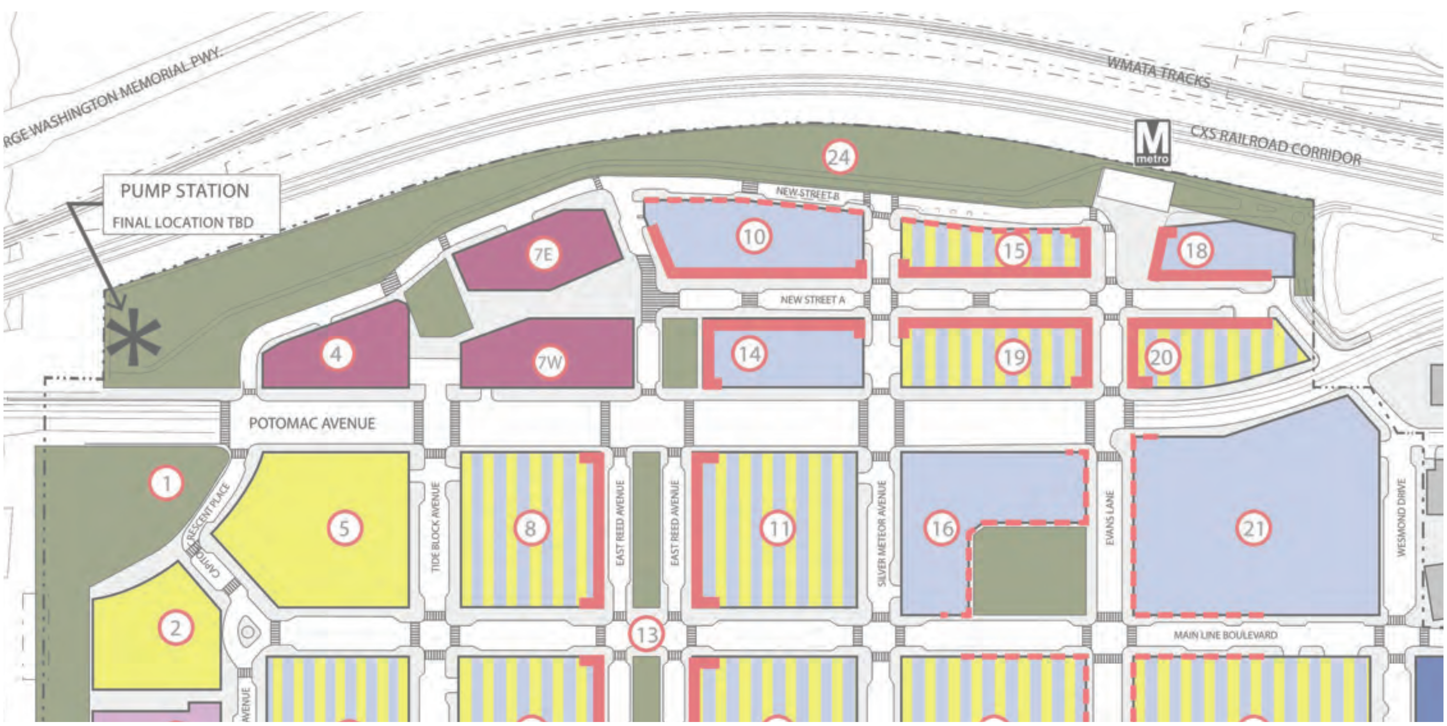
Mid-Term

- Create designated tree corridors- shade walkways, roads, hardscape features, and social gathering spaces.

Long-Term

- Incorporate cisterns, blue roofs, or other measures to support potable water demand and conveyance of greywater and blackwater, especially during loss of power, for 1 week.
- Revisit edges of the neighborhood that are prone to storm surges, and consider redeveloping portions into “flex” water features, capable of taking on water during storms and serving as a visual amenity.
- Incorporate battery storage banks to support building operations in the event of extreme weather events, natural disasters, loss of power. Plan for on-site storage to support critical power requirements for 1 week.
- Provide space to support urban agriculture, community supported agriculture (CSA’s), farmer’s markets, and other local food sources.
- Accommodate growth and change by incorporating adaptable spaces and elements using materials and systems that are easy to remove and replace based on market needs.

APPENDICES


RGE WASHINGTON MEMORIAL PWY.
WMATA TRACKS
metro
CXS RAILROAD CORRIDOR
PUMP STATION
FINAL LOCATION TBD
NEW STREET B
NEW STREET A
POTOMAC AVENUE
CRESCENT PLACE
TIDE BLOCK AVENUE
EAST REED AVENUE
EAST REED AVENUE
SILVER METEOR AVENUE
EVANS LANE
WESMOND DRIVE
MAIN LINE BOULEVARD
1
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4
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7E
7W
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24

Appendix: Phase 1 Strategies A

Strategies	Application of Strategies													
	SITE													
Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
Bioretention basin	X	X	X	X										
Pervious pavement	X			X							X	X	X	X
Cistern	X	X	X	X	X	X		X		X				
Retention pond											X			
Vegetated roof	X	X	X	X	X	X		X		X				
Vegetated swales				X							X	X	X	
Impervious surface disconnection	X	X	X	X							X	X	X	
Wet ponds	X													
Rainwater harvesting	X	X	X	X	X	X		X		X				
Tree pit bioretention	X										X	X	X	X
Long flow path for treatment	X										X			
Riparian buffer														
Mechanical filtration device	X	X	X	X										X
Native plant communities	X	X	X	X	X	X	X	X	X	X	X	X	X	
Treatment train	X	X	X	X										X
Unprogrammed open space	X	X	X	X	X	X					X			
Restored habitat	X										X			
Offsite habitat offset	X	X	X	X	X	X	X	X	X	X				
Active play area	X				X						X	X	X	
Rooftop usable space	X	X	X	X	X	X	X	X		X				
Tree canopy coverage	X	X	X	X							X	X	X	
Highly-reflective surface	X	X	X	X	X	X	X	X	X	X	X	X	X	
Sidewalk and trail network	X	X	X	X							X	X	X	
Connection hub	X	X	X	X							X	X	X	
Social and civic gathering space	X	X	X	X	X	X					X	X	X	
Onsite food production	X				X	X	X	X	X	X				

	WASTE													
Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
Demolition and construction diversion	X	X	X	X	X	X	X	X	X	X				
Waste to energy														
Solid waste management plan	X	X	X	X	X	X	X	X	X	X				
Composting	X	X	X	X	X	X	X	X	X	X				
Commercial recycling	X	X	X	X	X	X		X		X				
Residential recycling							X		X					
Zero Waste certification		X	X	X										
Infrastructure reuse														
Construction material reduction	X	X	X	X										
Participate in ongoing performance verification	X	X	X	X	X	X	X	X	X	X				
Bulk waste (electronics, furniture) recycling		X	X	X			X		X					

Key

X	Included in current design
X	Possible: needs further discussion
X	Under investigation
	Not under consideration

Appendix: Phase 1 Strategies

A

Strategies	Application of Strategies												

WATER

Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
WaterSense- labeled fixtures	X	X	X	X	X	X	X	X	X	X				
Low-flow water fixtures	X	X	X	X	X	X	X	X	X	X				
Rainwater reuse for irrigation	X	X	X	X	X	X	X	X	X	X				
Sanitary Wastewater Energy Exchange		X	X	X										
Participate in ongoing performance verification	X	X	X	X	X	X	X	X	X	X				
Greywater reuse for toilet flushing		X	X	X										
Condensate water reuse		X	X	X	X	X		X		X				
Rainwater reuse for cooling tower														
Wastewater reduction or reuse		X	X	X										
Irrigation controls (moisture, weather, etc)	X	X	X	X	X	X	X	X	X	X	X	X	X	
No irrigation beyond establishment period	X	X	X	X							X	X	X	

HEALTH & WELLNESS

Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
Low-VOC materials	X	X	X	X	X	X	X	X	X	X				
Product ingredient disclosure	X	X	X	X	X	X	X	X	X	X				
Access to quality views	X	X	X	X	X	X	X	X	X	X	X	X	X	
Access to daylight	X	X	X	X	X	X	X	X	X	X	X	X	X	
Biophilia- general	X	X	X	X	X	X	X	X	X	X	X	X	X	
Interior bio-walls for air treatment + circulation	X	X	X	X	X	X	X	X	X	X				
Water filtration		X	X	X										
MERV 13 air filters	X	X	X	X	X	X	X	X	X	X				
Ongoing water and air performance testing	X	X	X	X	X	X	X	X	X	X				
Green cleaning products	X	X	X	X	X	X	X	X	X	X				
Integrated pest management	X	X	X	X	X	X	X	X	X	X				
Develop equity plan (access + inclusion)	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bike storage and showers	X	X	X	X	X	X	X	X	X	X				
Acoustic absorption materials		X	X	X										
Water features		X	X	X			X		X		X	X	X	
Fitness facilities	X	X	X	X	X	X	X	X	X	X				
Participate in ongoing performance verification	X	X	X	X	X	X	X	X	X	X				
Fitness membership subsidies		X	X	X										
CSA Subscription Program							X		X					

RESILIENCE

Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
Emergency back-up power		X	X	X										
Demand control infrastructure	X	X	X	X	X	X	X	X	X	X				
Riparian buffer	X													
Implementation of resilience plan	X	X	X	X	X	X	X	X	X	X				
Flood management channels														
Rainwater management	X	X	X	X	X	X		X		X	X	X	X	
Back up communication channels		X	X	X										

Appendix: Phase 1 Strategies

Strategies	Application of Strategies													
	CARBON													
Possible Strategy	District-Wide	Block 4	Block 7E	Block 7W	Block 10	Block 14	Block 15	Block 18	Block 19	Block 20	PY Park	Metro Plaza	Mkt Square	Infrastructure
Power Purchase Agreements	X	X	X	X										
Solid waste emissions reductions														
EV car charging stations	X	X	X	X	X	X	X	X	X	X				
Carbon offsets	X	X	X	X										
Sanitary Wastewater Energy Exchange		X	X	X										
Flywheel energy storage					X	X	X	X	X	X				
Renewable Energy Certificates	X	X	X	X										
Solar orientation-informed design	X	X	X	X		X								
Priority parking for LEV vehicles	X	X	X	X	X	X	X	X	X	X				
Rooftop solar	X	X	X	X										
Vertical solar PV walls														
Building integrated photovoltaic		X	X	X										
Argon gas for IGUs	X	X	X	X										
Preatreatment of outdoor air	X	X	X	X	X	X	X	X	X	X				
High-performance low-E coating	X	X	X	X										
Triple pane IGU		X	X	X										
Electrochromatic glass		X	X	X										
Automatic shade controls		X	X	X										
verification	X	X	X	X	X	X	X	X	X	X				
Improved thermal enclosure	X	X	X	X										
VRF / VRV							X		X					
Optimized corridor ventilation	X	X	X	X			X		X					
Ground source heat pumps		X	X											
Radiant floor heating														
Phase-change wall insulation		X	X	X										
Lighting power density reduction	X	X	X	X		X	X	X	X	X				
Garage lighting LPD <0.1 W/sf	X	X	X	X	X	X	X	X	X	X				
Occupancy sensors	X	X	X	X	X	X	X	X	X	X				
Battery energy storage		X	X											
Active daylighting controls	X	X	X	X	X	X	X	X	X	X				
Public transportation subsidies	X	X	X	X	X	X	X	X	X	X				
Heat pump water heaters		X	X	X										
VFD controls	X	X	X	X	X	X	X	X	X	X				
Heat recovery		X	X	X										
Plug load controls		X	X	X	X	X		X		X				
High-efficiency LED site lighting	X	X	X	X	X	X	X	X	X	X	X	X	X	
EnergyStar appliances	X	X	X	X	X	X	X	X	X	X				
Central heat pumps- hydronic system		X	X	X										
Passive solar design		X	X	X		X								
Air barrier sealing + testing - exceed code		X	X	X										
Carbon sinks - landscape	X	X	X	X							X	X	X	
Embodied carbon reduction- structure		X	X	X										
concrete)	X	X	X	X	X	X	X	X	X	X				
Building Life Cycle Assessments	X	X	X	X	X	X	X	X	X	X				

Appendix: Sample LEED ND Scorecard B

SAMPLE - North Potomac Yard
LEED v4 for Neighborhood Development Plan
May 2020

Yes	?	No		Smart Location & Linkage	Possible Points: 28
16	3	9			
Y			Prereq 1	Smart Location	
Y			Prereq 2	Imperiled Species and Ecological Communities	
Y			Prereq 3	Wetland and Water Body Conservation	
Y			Prereq 4	Agricultural Land Conservation	
Y			Prereq 5	Floodplain Avoidance	
5		5	Credit 1	Preferred Locations	10
2			Credit 2	Brownfield Remediation	2
5	2		Credit 3	Access to Quality Transit	7
		2	Credit 4	Bicycle Facilities *Building Level*	2
3			Credit 5	Housing and Jobs Proximity	3
	1		Credit 6	Steep Slope Protection	1
1			Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1
		1	Credit 8	Restoration of Habitat or Wetlands and Water Bodies	1
		1	Credit 9	Long-Term Conservation Mgmt of Habitat or Wetlands & Water Bodies	1

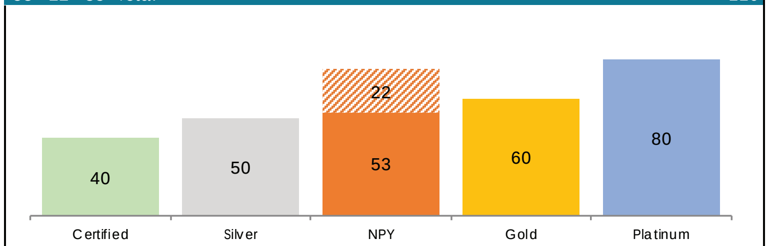
Yes	?	No		Neighborhood Pattern & Design	Possible Points: 41
18	12	11			
Y			Prereq 1	Walkable Streets	
Y			Prereq 2	Compact Development	
Y			Prereq 3	Connected and Open Community	
3	2	4	Credit 1	Walkable Streets *Building Level*	9
4		2	Credit 2	Compact Development	6
3	1		Credit 3	Mixed-Use Neighborhoods	4
2	3	2	Credit 4	Housing Types and Affordability	7
		1	Credit 5	Reduced Parking Footprint *Building Level*	1
	2		Credit 6	Connected and Open Community	2
1			Credit 7	Transit Facilities	1
1	1		Credit 8	Transportation Demand Management	2
1			Credit 9	Access to Civic & Public Space	1
1			Credit 10	Access to Recreation Facilities	1
	1		Credit 11	Visitability and Universal Design *Building Level*	1
	1	1	Credit 12	Community Outreach and Involvement	2
		1	Credit 13	Local Food Production	1
2			Credit 14	Tree-Lined and Shaded Streetscapes	2
	1		Credit 15	Neighborhood Schools	1

Yes	?	No		Regional Priority Credits	Possible Points: 4
4	0	0			
1			Credit 1.1	Regional Priority: Brownfield Remediation (th: 1)	1
1			Credit 1.2	Regional Priority: Housing and Jobs Proximity (th:2)	1
1			Credit 1.3	Regional Priority: Connected and open community (th: 1)	1
1			Credit 1.4	Regional Priority: Rainwater Management (th: 2)	1

Yes	?	No		Green Infrastructure & Buildings	Possible Points: 31
12	4	15			
Y			Prereq 1	Certified Green Building *Building Level*	
Y			Prereq 2	Minimum Building Energy Performance *Building Level*	
Y			Prereq 3	Indoor Water Use Reduction *Building Level*	
Y			Prereq 4	Construction Activity Pollution Prevention	
5			Credit 1	Certified Green Buildings *Building Level*	5
		2	Credit 2	Optimize Building Energy Performance *Building Level*	2
		1	Credit 3	Indoor Water Use Reduction	1
2			Credit 4	Outdoor Water Use Reduction	2
		1	Credit 5	Building Reuse	1
		2	Credit 6	Historic Resource Preservation and Adaptive Reuse	2
		1	Credit 7	Minimized Site Disturbance	1
2	1	1	Credit 8	Rainwater Management	4
	1		Credit 9	Heat Island Reduction. *Building Level*	1
		1	Credit 10	Solar Orientation	1
	1	2	Credit 11	Renewable Energy Production	3
		2	Credit 12	District Heating and Cooling	2
1			Credit 13	Infrastructure Energy Efficiency	1
		2	Credit 14	Wastewater Management	2
	1		Credit 15	Recycled and Reused Infrastructure	1
1			Credit 16	Solid Waste Management *Building Level*	1
1			Credit 17	Light Pollution Reduction *Building Level*	1

Yes	?	No		Innovation and Design Process	Possible Points: 6
3	3	0			
1			Credit 1.1	Exemplary Performance: LEED Certified Buildings (100%)	1
1			Credit 1.2	Exemplary Performance: 30% Reduction Infrastructure Energy	1
	1		Credit 1.3	Innovation: O&M Starter Kit *Building Level*	1
	1		Credit 1.4	Innovation: EV Chargers	1
	1		Credit 1.5	Innovation or Pilot Credit TBD	1
1			Credit 2	LEED Accredited Professional	1

Yes	?	No	Total		110
53	22	35	Total		110



Appendix: CDD Conditions Addressed in the ESMP C

CDD Conditions: Addressed in ESMP		
No.	**Condition**	**Document Reference**
55	*Green Building*	
55.a	LEED ND Silver	Section "Green Building and LEED"
55.b	LEED NC Silver - Office	Section "Green Building and LEED"
55.c	LEED NC Certified - Multifamily	Section "Green Building and LEED"
55.d	All Other Uses - Green Building Policy	Section "Green Building and LEED"
56	*ESMP*	
56.a	Identify methods for reducing carbon emissions	Section "Carbon", including subsections "Embodied Carbon", "Operational Energy", "Renewables", "Transportation toolkits
56.b	Phasing Plan for implementing ESMP	Section "Introduction"
56.c	Estimate of CO2e emissions utilizing carbon footprint calculator, focusing on pimary sources of CO2 such as buildings, solid waste, transportation	Section "Carbon", within "Background""
56.d	Narrative outlining district-wide sustainability, energy, and environmental systems to be utilized	
56.e	Demonstrate zero or low emissions vehicles shall be given preferred parking	Section "Carbon", within subsection "Transportation" toolkit
56.f	Identify proposed methods of complying with LEED/Green Building goals noted in green building condition	Section "Green Building and LEED"
56.g	Identify how per capital energy use shall be reduced	Introduction, Section "Carbon", within subsection "Operational Energy" toolkits
56.h	Explore feasibility of tracking multi-family residential energy usage; provide tracking documentation at first occupancy	Section "Carbon", within subsection "Operational Energy", under "Measurement and Verification" toolkit
56.i	Identify emerging technologies, clean/renewable energy sources	Section "Carbon", within subsection "Renewables"
56.j	Include solid waste management plan; address reduction, reuse, recycling, recover and proper disposal per Article H to Title 5 (Ordinance 4438) of Alexandria City Code	Exhibit - "NPY Solid Waste Management Plan- Example.pdf"
56.k	Construction and Demolition Waste Management Plan; address reuse, recycling, and proposal disposal	Exhibit - "NPY Construction Waste Mgmt Plan- Example.pdf"
56l	Identify location/programs providing identification, exposure, and educational opportunities for building users and pedestrians within development regarding implemented sustainable measures	Section "Waste", subsection "Ongoing Operations", specific to waste disposal; Section "Carbon", subsection "Renewables", specfiic to transition to renewables; Section "Health and Wellness", subsection "Indoor Air Quality", specific to common practices by occupants, cleaning protocols, and building engineer training; Section "Health and Wellness", subsection "Comfort", specific to fitness and mindfulness educational material; Section "Resiliency", subsection "Climate Change", specific to community ecosystem services
56.m	Summarize sustainable aspects of Water Management Master Plan and Comprehensive Open Space Plan (P&Z) (T&ES)	Section "Site", subsection "Open Space", "Stormwater"
57	Install low flow fixtures per <u>*North Potomac Yard Small Area Plan*</u>	Section "Water", subsection "Potable Reduction", short term toolkit
58	*Water Management Plan*	*tbd- not written*
58.a	Identify predevelopment and postdevelopment phosphorous loading in lbs/ac/yr	Section "Site", subsection "Site Benchmarks"
58.b	Identify percentage reduction in phosphorous loading	Section "Site", subsection "Site Benchmarks"
58.c	Identify stormwater management and low impact design facilities; per Virginia BMP Clearinghouse an/dor City's green Sidewalk BMP Guidelines	Section "Site", subsection "Stormwater"
58.d	Identify Resource Protection Area revegetation measures if appropriate	Section "Site", subsection "Habitat"
58.e	include low flow fixtures, water conservation measures, other facilities or infrastructure to reduce or manage generation of municipal wastewater	Section "Water", subsections "Potable Water Reduction" "Reuse Opportunities" "Process Water"
59	Demonstrate a reduction in phosphorous loading (40%)	Section "Site", subsection "Site Benchmarks"
62	Design 50% of roof areas with sustainable practicies; 25% with vegetated roof / 25% with vegetated roof, solar, other sustainable practices	Section "Site", subsection "Open Space" "Habitat" "Heat Island", short-term toolkits and subsection "Site Benchmarks"

Appendix: CDD Conditions Addressed in the ESMP, cont.

63	Identify rainwater harvesting and reuse systems; 15% of average annual runoff from impervious rooftop to be used for irrigation or other approved purposes	Section "Water", subsection "Water Benchmarks"
64	Identify porous pavement systems; porous pavement w/ underdrains at all on-street parking, porous paveres for public sidewalks, curbside bioretention to treat roadways	Section "Site", subsection "Stormwater", short-term toolkit
65	Four Mile Run shall be revegetated in a manner compatible with riparian buffer areas	Section "Resiliency", subsection "Climate Change" long term toolkit
73	Designate 35% of the land area (69.07 ac) as open space; 15% shall be ground-level or roof-top open space; Open water and public right-of-ways shall not be counted	Section "Site", subsection "Open Space", "Site Benchmark"
74	Submit a Compreshensive Open Space Programming Plan identifying open space programming for each park; Include a mix of active and passive amenities	Section "Site", subsection "Open Space"
74.a	Active recreation like volleyball courts, tennis courts, basekball courts, playgrounds, climbing walls/gym, splash grounds, ice skaing rinks, pools, dog exercise areas	Section "Site", subsection "Open Space"
74.b	Event space/festival area for small concerts or community events, play areas, dog exercise areas shall be provided at grade, along with other active amenities	Section "Site", subsection "Open Space"
74.c	Passive recreation amenities include trails, promenades, plazas, fountains, restrooms, overlooks, open law aras, seaing, public art, gardens	Section "Site", subsection "Open Space"
74.d	Parks shall be designed with high quality special paving, furnishings, ligthing, electrical service, irrigation, active and passive amenities	Section "Site", subsection "Open Space"
74.e	Include a network of private and public open space that is integrated with adjacent park property and regional park system	Section "Site", subsection "Open Space"
74.f	Cooridnated, constructed, approved for adjacent open space in Landbays E, G, K	Section "Site", subsection "Open Space"

Appendix: NPY Small Area Plan Recommendations C

NPY Small Area Plan: Environmental Sustainability & Performance Recommendations Addressed in the ESMP		
Topic	**Recommendation**	**ESMP Document Reference**
Environmental Leadership		
2.1	North Potomac Yard should strive to achieve carbon neutrality by 2040, and to strive to achieve carbon neutrality by 2030.	Section "Introduction and Executive Summary" - "Sustainability is Top-of-Mind" and "Targets for Success," Section "Carbon"; Appendices A and C
2.2	Provide a mix of land uses and a transit-oriented development as part of the redevelopment of the Plan area.	Sections "Site," and "Carbon" - "Transportation"
2.3	Explore the possibility of community gardens so that residents and visitors can have access to edible and non-edible plantings as well as offer a unique educational opportunity.	Section "Site" - "Open Space," and Section "Resilience"
Reduce Energy Use		
2.4	Explore a minimum of LEED Silver or comparable, or the City's green building standards and requirements, whichever is greater. In addition, new buildings will comply with the Environmental Action Plan (EAP), as implemented through City policies. Energy consumption/utilization and stormwater should be prioritized in the certification for the buildings.	Section "Introduction and Executive Summary" - "Synergies and Structure," and "Goals", Section "Green Building and LEED"; Appendices A and C
2.5	Encourage on-site generation and storage of renewable electricity from solar photovoltaic (PV) and other available renewable resources.	Section "Site" - "Heat Island," Section "Carbon" - "Renewables", Section "Resilience" - "Infrastructure"
2.6	Integrate the use of natural daylighting in all proposed buildings.	Section "Carbon" - "Operational Energy", Section "Health and Wellness" - "Comfort"
District – Wide Sustainability Measures		
2.7	Require the submission of an Environmental Sustainability Master Plan as part of the submission of the first development special use permit (DSUP) that demonstrates the compliance with the goals and recommendations of the Plan and identifies short-term, mid-term and long-term strategies to achieve the goal of district-wide sustainability measures. The Plan should be updated with each subsequent block(s) and/or building(s) to show how the project achieves the Plan's goals.	Section "Introduction and Executive Summary" - "Phases," and "Timeline-Based Sustainable Strategies"; Appendices A and C
2.8	Require Plan area-wide sustainability through LEED-ND Silver or comparable.	Section "Green Building and LEED"; Appendix B
2.9	Explore the development of district energy systems for heating and cooling that take advantage of local renewable energy sources, including but not limited to geothermal energy, sewage heat, anaerobic digestion, and waste heat from buildings.	Section "Carbon"
2.10	Require the provision of green roofs for new development.	Section "Site," - "Stormwater," "Open Space," "Habitat," and "Heat Island"
2.11	Provide an integrated open space network, which incorporates environmental components as part of its design.	Section "Site," s- "Open Space"
2.12	Design new development to prioritize travel by pedestrians, bikes, and transit, and minimize the need for car use.	Sections "Site," and "Carbon" - "Transportation"
2.13	Provide affordable housing within ½ mile of the Metrorail station.	Section "Green Building and LEED"
Reduce Stormwater Runoff – Water Conservation		
2.14	Establish minimum quantities of green roof and/or solar power generation on building roofs.	Section "Site," - "Stormwater" and "Heat Island," Section "Carbon," Section "Introduction and Executive Summary" - "Targets for Success"
2.15	Encourage reuse of captured rainwater.	Section "Water" s- "Reuse Opportunities"
2.16	Require stormwater management, and, if feasible, recaptured water- to be integrated as part of the street, open space, and proposed buildings design.	Section "Site" - "Stormwater"
2.17	Encourage water conservation using sustainable methods such as ultra-low and/or low flow plumbing fixtures.	Section "Water" - "Potable Reduction"
2.18	Use native plant species and water-efficient landscaping.	Section "Site" - "Stormwater" and "Habitat," Section "Water" - "Potable Reduction," "Reuse Opportunities", and "Process Water"
Design for Longevity		
2.19	Design buildings for long-term aesthetic appeal and flexibility for future changes in use.	Section "Carbon" - "Embodied Carbon", Section "Resilience"
2.20	Utilize quality building materials that consider the long term life cycle of the building.	Section "Carbon" - "Embodied Carbon"
2.21	Maintain a walkable small block network of streets and sidewalks for pedestrians; avoid super blocks.	Sections "Green Building and LEED" and "Site"; Appendix B

Appendix: Sample Plans D

Construction Waste Management Plan

Scope

This plan applies to all waste related to construction and demolition activities. This policy will be consulted prior to arranging for waste disposal. The Project Team is responsible for designating a Construction Waste Management point of contact to oversee the requirements of this plan are implemented. All subcontractors will be required to assist the Project Team with the requirements.

Goals

Divert a minimum of **75%** construction and demolition materials from the landfill. Identify at least five different materials to be diverted from landfills or incinerators, and whether the materials will be sorted on site or comingled. Calculations can be done by weight or volume, but must be consistent throughout. Land clearing debris and hazardous waste are not included in the calculation.

Method

The contractor will identify all the materials on-site that can be salvaged or recycled and develop a list of the location and method of disposal. Identify at least five materials to be diverted. Materials that have a high probability of being recyclable and will contribute to the diversion rate and are listed in the table below.

The following diversion rates will be targeted:

Recyclable Material	Target Diversion Rates	Percentage of Overall Waste Stream
Drywall	30%	%
Concrete	10%	%
Rebar	25%	%
Insulation	10%	%
Metal	20%	%
Cardboard	%	%
Wood	%	%
Carpet	%	%
Brick	%	%
Concrete Masonry Units	%	%
Asphalt	%	%
Total	75%	100%

Waste generated through demolition and construction activities will be collected and stored onsite. Recyclable and landfill materials will be collected in two separate containers. Recyclable materials will be comingled and sorted off site by the waste hauler. Proper signage will be provided to identify the materials collected in each container. The contractor will monitor the containment areas to prevent contamination.

Recycling Procedures
It is anticipated that dumpsters will be provided for all commingled recyclables.
All construction waste will be delivered to a recovery facility for separation will then separate these materials into the correct category (plastic, metals, etc.) off-site, where the contents will also be weighed and the tonnage figures will be converted into landfill diversion percentages for the project. The following containers will be provided:

- 20 yard dumpsters – For heavier materials, such as concrete and asphalt.
- 30 yard dumpsters – For general construction & demolition waste.

Designated areas will be established for construction and demolition recycling. Recyclables and salvageable waste products will be protected, handled and stored at the site in a manner that maximizes recovery of identified materials. Generally, materials shall be recycled as followed:

- Cardboard and Mixed Paper – break down and keep dry, recycle
- Carpet and pad – return to manufacturer, recycle remaining
- Ceiling Tile – Reuse when possible, recycle remaining
- Untreated wood – Remove metal, recycle
- Metal – separate and recycle
- Gypsum – aim to break down in large pieces, recycle
- Doors, frames – reuse or recycle
- Glass – contact local community organization for donation, recycle

Note that for any fluorescent lamps, high intensity discharge lamps and mercury-containing thermostats removed from the site shall also be recycled. In the event that they are generated on-site, these materials will be stored in an enclosed recycling container. This container will be labeled as containing universal waste and the date this waste was first generated shall be specified on the container. Any broken bulbs will be placed in a vapor tight container, which will not be reopened prior to disposal.

Performance Metrics
The waste hauler will remove each storage container onsite as needed. The hauler will provide the contractor a report of the materials removed from the project site. The report will contain the weight or volume of each material waste stream and the location of disposal or diversion. The contractor will compile all waste reports and provide monthly tracking sheet to the LEED consultant. The monthly tracking report shall include the information in the following table. The reports will clearly identify the amount of material recycled, salvaged, and disposed in the landfill.

Material	Hauler/Location	Disposed In Landfill (tons)	Recycled/Salvaged (tons)
Material	Hauler/Location	Disposed In Landfill (tons)	Recycled/Salvaged (tons)
Asphalt			
Concrete			
Metals			
Wood			
Glass			

Appendix: Sample Plans D

Brick			
Paper			
Cardboard			
Plastic			
Gypsum			
Insulation			
Other			
Total			

Communication
The waste management plan will be distributed to all subcontractors and will be included in weekly discussion with subcontractors. Appropriate signage will be installed so that all contractors and subcontractors can identify the proper collection container of disposal.

Contacts

Title	Name	Email	Telephone
General Contractor			
Hauler			

Appendix: Sample Plans D

Solid Waste Management Plan

Scope

This plan applies to all ongoing waste leaving the building. This policy will be consulted prior to arranging for waste disposal. This policy covers the following:

- all ongoing waste, including the ongoing purchasing including: food and beverage waste, containers, paper, office supplies
- office equipment, appliances, audiovisual equipment
- electric powered equipment
- hazardous waste, such as mercury-containing lamps and batteries

Goals

To encourage diversion of waste from landfills materials in the building.

- Ongoing consumables
  - At least 50% of the total ongoing consumables disposed during the performance period are to be recycled or diverted, with the additional goal of exceeding at least 70%.
  - Separate mixed paper and comingled containers from refuse for recycling in each multiple-family dwelling.
- Durable Goods
  - Reuse or recycle at least 75% of the durable goods during the performance period.

Performance Metric

Waste generating will be tracked by building management and appointed representatives of each tenant. Management will provide the tenant and all management personnel Solid Waste Tracking log. Inputs to the tracking log include:

- Date of disposal/recycle/compost
- Type of waste.
- Amount of waste.
- Disposal method.
- Total waste generated monthly

Procedures

The procedures and strategies to meet the goals and intent of this policy are as follows:

- Provide easily accessible recycling and composting areas for all building occupants that accept cardboard, paper, metals, plastic, and glass at a minimum.

- Housekeeping must empty all recycling areas within the building into the central recycling storage area for the whole building. The building management will have a contract with a waste management company to pick up comingled recyclables.
- The waste management company must perform waste stream audits at the request of the property management. Waste stream audits must be performed during the performance period to document the waste disposal methods for the whole building.
- The waste management vendor must report waste stream audit results to property manager.

Responsible Party

Teams and individuals involved in activities pertaining to this policy.

- Property Manager – Key tasks include contracting with vendor to take comingled recyclables and perform waste stream audits.
  - It is the property manager's responsibility to work with the tenant to identify opportunities for recycling in the building.
  - The property manager must track waste disposal methods for the building management's control.
- Tenant Main Contact – The tenant main contact will be responsible for tracking waste disposal methods within the tenant's control. This person will report to the property manager each month of the performance period.

Contacts

Title	Name	Email	Telephone
Property Manager			
Vendor			

Image References

Cover Images
Metro tracks: NPY Small Area Plan
Park rendering: NPY Small Area Plan
Streetscape rain garden: State College, PA
PV panels: ICB Projects, SunPower

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